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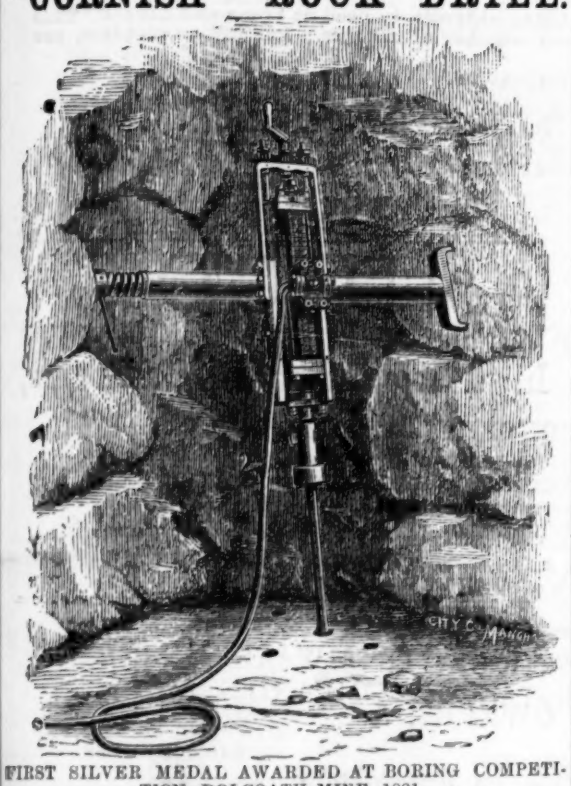

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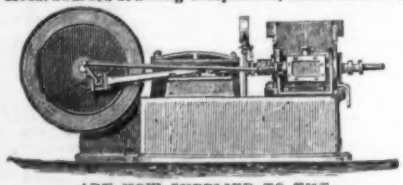

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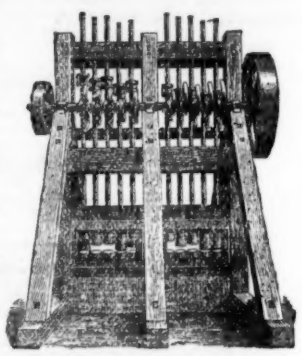

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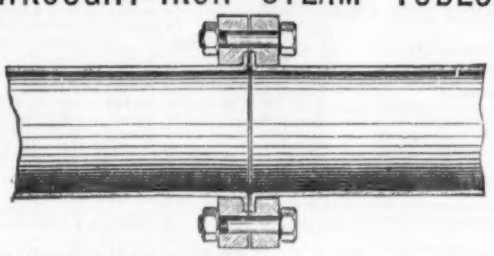

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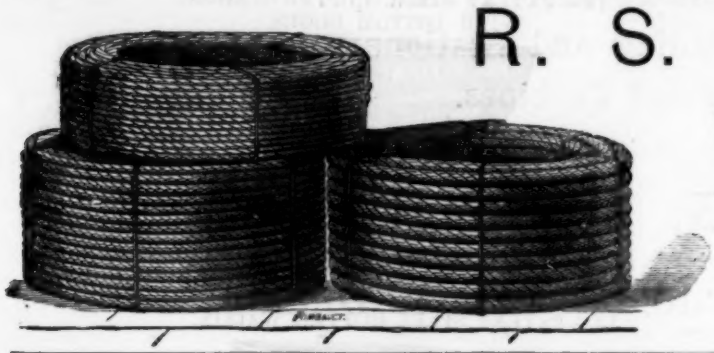

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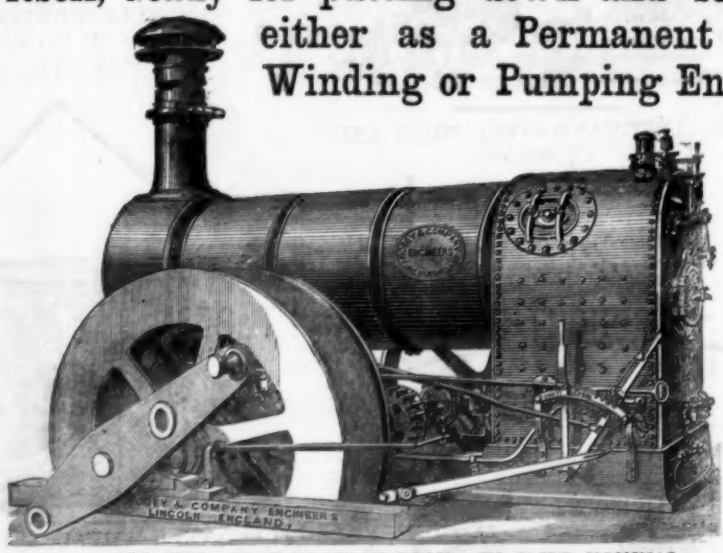

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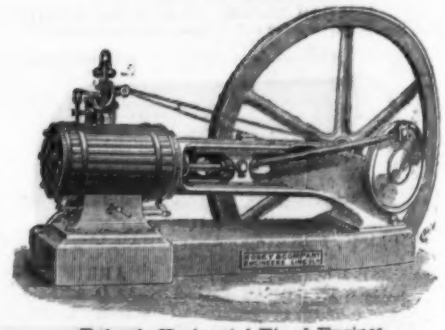

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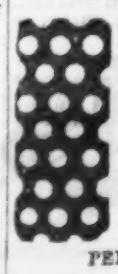

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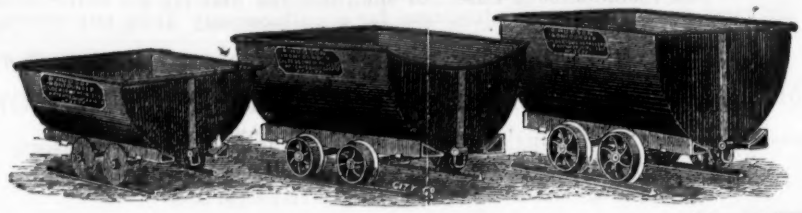
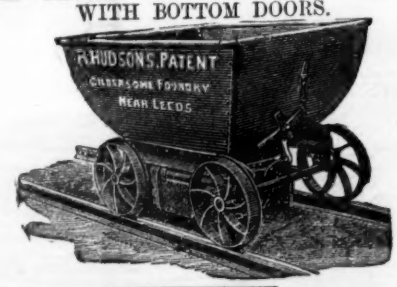
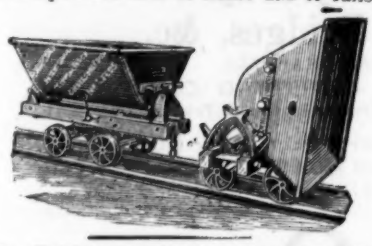


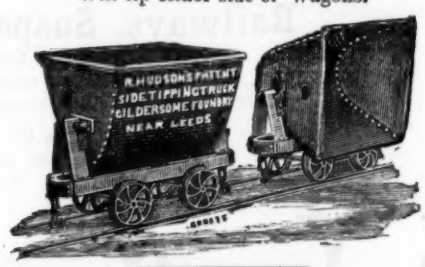
12.—PATENT STEEL HOPPER WAGON, WITH BOTTOM DOORS.



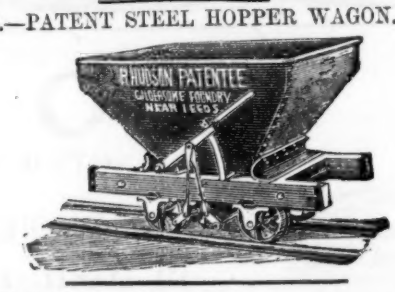
2. PATENT UNIVERSAL TRIPLE-CENTRE STEEL TIPPING TRUCK,
Will tip either SIDE or either END of rails.



8.—PATENT DOUBLE-CENTRE STEEL SIDE TIP WAGONS,
Will tip either side of Wagons.

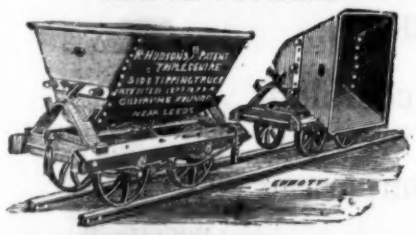


13.—PATENT STEEL HOPPER WAGON.

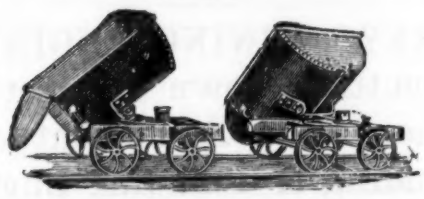


ONE man can EASILY tip ANY WEIGHT in these wagons.

3.—PATENT TRIPLE-CENTRE STEEL SIDE TIP WAGONS.

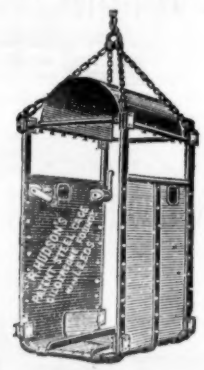


9.—PATENT STEEL ALL-ROUND TIP WAGON.

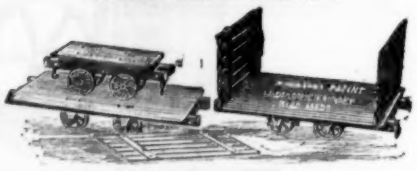


14.—SELF-RIGHTING STEEL TIP BUCKET.
(The "CATCH" can also be made SELF-ACTING if desired.)

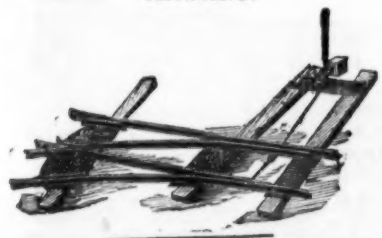
15.—STEEL CAGE.



4. PATENT STEEL PLATFORM OR SUGAR CANE WAGON.



10.—LEFT-HAND STEEL POINT AND CROSSING.



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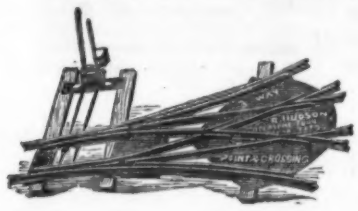

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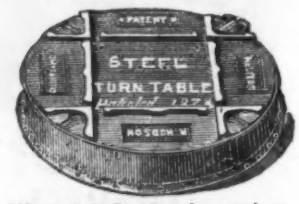

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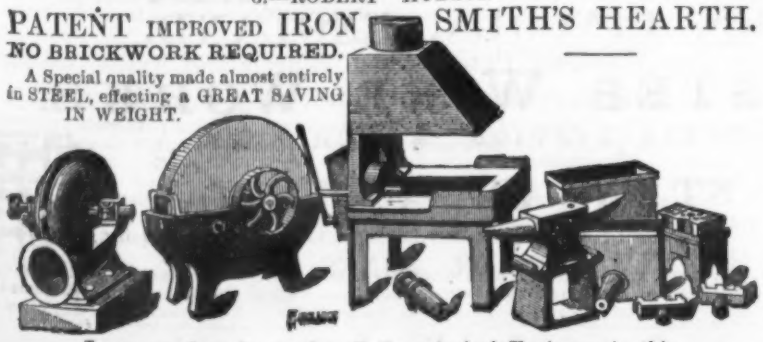

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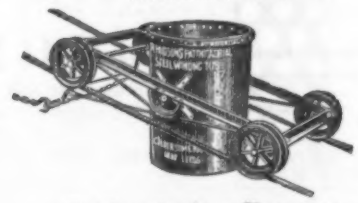

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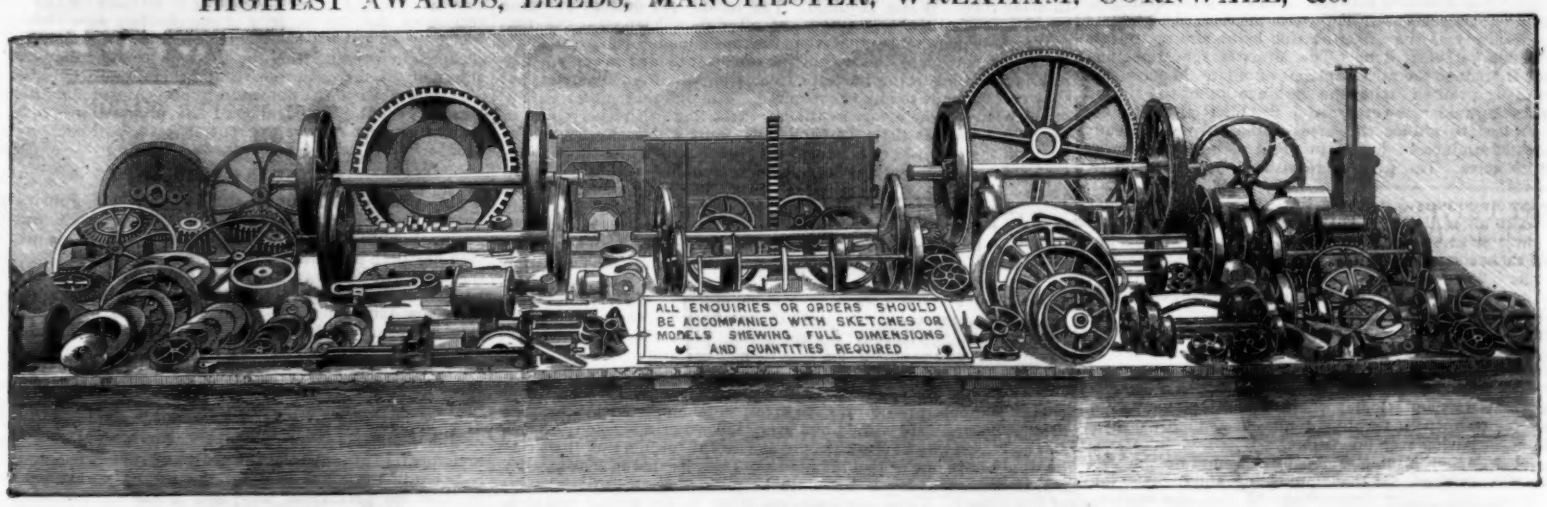
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HADFIELD'S CAST STEEL WHEELS.

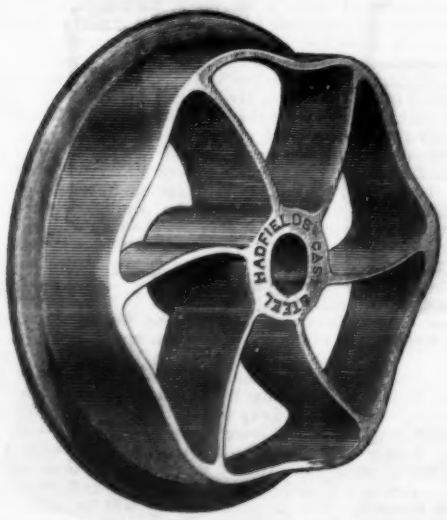
One of our departments is specially adapted for the production of our Patent Steel Wheels and Axles for collieries, tramways, ironstone mines, slate quarries, ironworks, lead mines, &c., and we are now manufacturing **2000** per week. Owing to our patent system of fitting-up Wheels and Axles, which is simple but effective, we are enabled to execute orders with promptitude. We undertake to supply all work entrusted to us in a first-class manner, and only manufacture the BEST quality of material. OVER 1600 DIFFERENT WHEEL, PULLEY, AND PEDESTAL PATTERNS IN STOCK, of varying widths of tread, flanges, &c., any of which can be ready for use at the shortest notice.

In addition to the now universally admitted superiority of Hadfield's steel wheels over those of cast-iron for lightness, strength, and wearing qualities, we claim the following SPECIALITIES for our material over any other steel, malleable iron, or other wheels, viz.:—

Extra TOUGHNESS or TENACITY, DURABILITY, and SOLIDITY: for proof of this kindly read the undermentioned.

X

TOUGHNESS

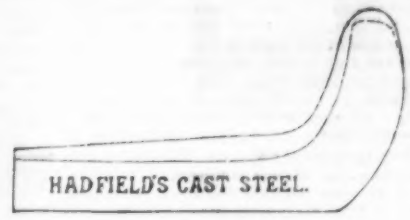


Special attention is drawn to the slight indendations produced by the numerous and heavy blows, thus bearing out our claims for producing a special tough and tenacious steel which will not break or bend easily out of shape, and thus withstand the rough usage experienced at collieries, &c.

X This view represents one of Hadfield's Steel Wheels taken out of stock, bedded upon an anvil (thus getting full force of blow), then hammered COLD with no less than 45 swinging blows of a 14 lb. steel sledge hammer. We undertake that this same wheel, which may be seen at our works, can be heated in a smith's fire, straightened and put to use again; or if desired, a piece therefrom drawn out into a chisel, knife, &c.

This only represents an ordinary specimen of our manufacture.

DURABILITY



Section taken from a wheel kindly furnished by a customer who has many thousands at work. This wheel has run **40,000** miles, carried nearly **10,000** tons of coal, and although at work almost night and day for over five years is only worn so slightly, as shown above—**one-eighth of an inch!!** The wheels in question were 9 inches diameter, and weighed only **14** lbs. each when put to work. This is only one out of many similar examples of the extraordinary durability of our material.

Prices **per set** furnished on receipt of sizes, either for wheels only or fitted together with Steel Axles by our well-known patent **fast** method. *When so fitted by us we undertake that our wheels shall remain* **fast** *as long as the wheels and axles last.* Upwards of *half-a-million* are now in daily use fitted by Hadfield's patent fast method. This is the only system that successfully withstands the great strains experienced in collieries, &c., without working loose.

NOTE.—Beware of spurious and cheap imitations which eventually work loose, causing great loss and annoyance, as well as bringing discredit on the name of Steel Wheels and Axles. We are constantly replacing such. See, therefore, that Hadfield's name is on every wheel.

We also solicit attention to the following articles, which, in addition to our well-known Patent Steel Wheels and Axles, we are now largely supplying in our CAST STEEL, on account of their great strength combined with durability and lightness.

Rollers, Pulleys, Frames, and Stands.—See our lists of over 240 different patterns. They possess great durability, lightness, and strength, and add considerably to the life of the steel or other ropes.

Self-oiling Wheels (Patent).—Many thousands now at work. Save at least 50 per cent. of oil or grease. Easily charged or refilled. Reduce friction and wear and tear to a minimum.

Pedestals, Bushes, Cage Guides, Buffer Boxes, Points, Crossings, and other Colliery Castings of every description.

Over 1700 different patterns of above in stock, ready for use on the shortest notice. New patterns made to suit special requirements free of charge for quantities.

Steel Axles to suit all classes of haulage. We manufacture a special mild quality of steel suitable for this purpose, and have many *hundreds of thousands* in daily use giving every satisfaction.

Steel Gearing of all kinds. Machine moulded or from full patterns.

Miscellaneous Steel Castings, up to 16,000 lbs. each, to replace expensive wrought-iron and steel forgings and heavy iron castings. Tensile strain of our castings 35 to 65 tons per square inch (as tested by Government) varying according to purpose required, with 20 per cent. elongation.

Note.—Beware of spurious and cheap imitations which eventually work loose, causing great loss and annoyance, as well as bringing discredit on the name of Steel Wheels and Axles. We are constantly replacing such. See, therefore, that Hadfield's name is on every wheel.

N.B.—Note the Address, and prove truth of the above by giving our Steel Wheels, &c., a trial.

HADFIELD'S STEEL FOUNDRY COMPANY, HECLA WORKS, ATTERCLIFFE, SHEFFIELD.

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Original Correspondence.

AUSTRALIAN MINING PROGRESS.

SIR,—Silverton is assuming an air of importance; it can boast of its banks, stores, seven hotels, barbers' saloons, blacksmiths' smithies, chemists' stores, saw-mill and timber yard, crushing-mill, livery stables, and a weekly newspaper (Silver Age), with a population of between 5000 and 6000. Mark the want, no church. Carriage of goods from Port Adelaide, 9*l.* 10s. per ton. It is estimated that something like 300 teams are engaged carrying to and from it. It will not be long before this mushroom town finds a rival near to where the rich find of tin was got, some six weeks ago—Purnamoota, or Soakage, or Leadville. This latter is its new name, and is about 19 miles north-east from Silverton; an hotel is in course of erection, besides several stores, &c. To the east of Leadville are some promising silver claims—the Horns, Braeds, Nichols, and Collins, and another taken up by a Sydney syndicate. An immense lot of horn silver (chloride of silver) has been taken from the surface of some of these claims in the shape of slags.

South from these claims is Mount Gipps Hotel, 11 miles distant, around which are several claims very rich indeed. The formost of these is Hall's, now the property of a South Australian syndicate. An assay of ore from this claim yielded 13,000 ozs. per ton, nearly equal to in yield to Mackay's Comstock, in Nevada. A trial shipment from this claim has been despatched to England. Adjoining Hall's are three or four others, yielding from 4000 to 6000 ozs. to the ton. In a south-west direction, at a distance of 12 miles from the hotel, is the Pinnacles claims, which is said to have the biggest show in the world of stuff, but the ore here is not of high quality; it is the quantity that can be raised with so little trouble which claims for them a valuable position. A contract has been entered into with Messrs. Mort and Co., Sydney, for a 45-ton smelting plant, to be delivered in Adelaide in 12 weeks from the date of contract by the proprietors of the Pinnacles. A small sample of silver ore from the Lubra claim, Silverton, realised 834*l.* per ton in London.

The Legislative Assembly last week voted 1,050,000*l.* for the construction of a light railway (340 miles), starting from Forbes to Wilcannia, on the River Darling, tapping Mount Hope and Nymagee on the way (copper mines). Although six weeks ago a memorial was forwarded to the Postmaster-General, through Mr. Machattie, M.L.A., offering to guarantee 5 per cent. on the cost of the line of telegraph wire; no reply has yet been received. A line from Menindie to this place would be between 70 and 80 miles in length.

The Emmaville district has been in a continued state of high fever ever since the discovery of the silver-bearing lodes, and up to date no real mining has yet been done. The Minister for Mines has been petitioned to reduce the area of claims of 40 to 80 acres, and applications already granted under the 28th Section of the Mining Act, but of course refused. However, Mr. J. P. Abbott, the Minister, although he refused to reduce the area of those permits already granted, he has determined in future to grant permits for an area not exceeding 20 acres. The petitioners wished the area to be reduced to 10 acres.

Tent Hill is an old mining district for tin. Two silver lodes have been discovered 10 miles distant. The first by Webb and party, who have secured three 80 acres blocks, and have opened a lode in two places; one of these showed a vein of galena 2 ft. wide, and another place 18 ft. wide. The second by Cassidy and party, who have secured six 40 acres blocks. Cassidy's lode is about 2 miles east from Webb's, and shows a vein of 20 ft. wide.

The Russian engineer (Micheal Schostak), who I reported in my last letter was visiting Victoria, has come north to give us in New South Wales a look on his rambles. He visited one of the large collieries in this district (Newcastle), and also had a look at a diamond drill in operation at Maitland, Goole, where the superintendent of drills is boring for water. He expressed himself as highly pleased with the drill, never having seen one before.

The Great Cobar Copper Mining Company telegram for the week ended Oct 14:—Ore smelted, 484 tons, producing equal to 60 tons fine copper; 56 tons fine copper despatched: 16 furnaces working. Heavy showers this morning; still threatening.—The mining manager reports for the four weeks, ending Oct. 4:—Underground: The timbering for bringing the skip-road to the bottom of Barton's shaft has been continued to a height of 110 ft. from the bottom. At the 54 the nine men breaking ore at the back of this level, and 150 feet north of the shaft, have 500 tons broken, and ready for pulling up when required for blast-furnace. At the 39 the end of the new discovery has been extended 30 ft. further north, opening up a distance on this lode of 65 ft.; the ore driven through during the month is principally sulphurets. The lode referred to in my last report as being met with in No. 2 cross-cut proved to be only a series of branches, and from the course of the lode on the 65 ft. opened up it would appear that the lode is further to the east than we first anticipated. The cross-cut will require to be driven a further distance to get into the same. The diamond drill has put in a bore 163 ft. east of the 39, at Renwick's shaft, in section 20; the bore was through country, and only passed through a small vein of quartz at 160 ft. in. The bore is still being extended, and we purpose continuing to a distance of 300 ft., in order to prospect the eastern ground. For convenient working of the ground at the bottom of the 39 it has been found necessary to open up an intermediate level 40 ft. below this level in Barton's shaft, and the same has been done to a distance of 14 ft. from the shaft; the lode here is composed of grey ore mixed with gossan and iron. The stopes at the back of the 39, in sections 9 and 10, are producing grey ore and oxides, and show favourably for yielding large quantities of this kind of ore. About 2000 tons of ore have been raised from the 39, 26, and 15, and the mine throughout is in good working order. Another kiln of about 700 tons sulphuret ore has been put together, and is now burning: 1791 tons of ore have been smelted, producing equal to 225 tons: 225 tons of fine copper have been made, and 228 tons of fine copper despatched.—By wire for week ended Oct. 11: Ore smelted 560 tons, producing equal to 60 tons fine copper; 31 tons of fine copper despatched; 16 furnaces working; weather fine.—Telegram for the week ended Oct. 18: Ore smelted 470 tons, producing equal to 53 tons fine copper; 45 tons fine copper despatched; 13 furnaces working; start another to-night.

The Nymagee Copper Mining Company output for the week ended Oct. 4 is 266 tons of ore smelted, producing equal to 40 tons of refined copper. Despatched 23 tons.—The yield for the week ended Oct. 11 was 262 tons of ore smelted, producing equal to 40 tons of refined copper. Copper despatched, 30 tons.—The mining manager for month ended Oct. 11:—Barton's Shaft: The north end in the 69 has been extended a further distance of 34 ft., making in all 55 ft. from shaft. The ground has eased very much here since last report; consequently, rapid progress has been made, and should the present good ground continue I expect to intersect during the ensuing month the rich sulphuret ore mentioned or previously reported in the bottom of the winze, section 14. Judging by the appearances I think we shall find the ore nearer the shaft in this level than in the upper levels.—52 Fm. Level: The north end has been driven a further distance of 14 ft. 6 in., making a total of 412 ft. from shaft. This drive is in a good lode, and is close up to the winze in section 17. The back stope in section 14 continues much the same in appearance, but in the meantime the men are engaged filling up, &c.—40 Fm. Level: The back stope in section 14 continues to yield good ore, and has been relet at 4s. 6d. per ton for two months. In section 17 I am sending up a quantity of ore that has been accumulating for some time past, and shall timber the level preparatory to further stoping here. Hardie's shaft, in section 6, has been sunk a further depth of 25 ft., making in all 75 ft. from surface, and relet to communicate with the level below, which will occupy from six to eight weeks. In the meantime all other works in this section have been discontinued until the shaft reaches the 147 feet level. During the month 900 tons of ore have been raised and 1090 tons smelted, producing equal to 167 tons of fine copper. Fine copper made, 150 tons; and despatched 141½ tons.

The following is a return of tin ore received at Newcastle and Morpeth for the week ended Oct. 4:—From Glen Innes to Newcastle, 5 tons 9 cwts. 1 qr.; Glen Innes to Morpeth, 16 tons 11 cwts.; Guyra to Newcastle, 6 tons 1 cwt. 1 qr.; Guyra to Morpeth, 7 tons 1 cwt. 1 qr.; Uralla to Newcastle, 15 tons 6 cwts. 0 qr. 12 lbs.; Uralla to Morpeth, 14 tons 8 cwts. 3 qrs. 22 lbs.: total, 64 tons 17 cwts. 3 qrs. 6 lbs.

IOTA.

MANUFACTURING ENTERPRISE—NEW SOUTH WALES.

SIR,—Although the subjoined account of the opening of the New South Wales Rope Factory is rather foreign to your general subject matter, still as it deals with machinery—the whole of which is English make—it may possibly interest some of your readers. The opening ceremony in connection with the above new work was carried out by Mr. Thomas J. Laby (owner), and a few friends. The factory itself covers an area of about three acres, and is situate in a flat of the country a few miles from the township of Parramatta, and has two railway stations, or platforms, adjoining the ground on which it is built, the locality being in every sense of the word a charming one, abounding with fruit gardens, &c., of various descriptions. The works opened yesterday, which are the sole property of Mr. Laby, are fitted out with new machinery of the latest improvements for the manufacture of rope, twine, &c., and an efficient manager of long experience at the trade in Victoria (Mr. Forster) is placed in charge of it by the energetic proprietor, whose ultimate aims are to create a township through large employment of labour in the vicinity of his gigantic establishment, where at present there are only a few residences and two stores. The contractors employed by Mr. Laby were Messrs. Kerin and Steel, of Burwood, and the architect, Mr. M'Creedie, of Wynyard-square, the whole being carried on under his own personal supervision. The boiler employed to work the machinery is a multitubular one, 18 ft. 7 in. long by 7 ft. in diameter, and was made by Anderson and Sons, Anbley Boiler Works, Accrington, England. The furnace is steel, and is 10 ft. long by 3 ft. 9 in. in diameter. The engine is the Corliss, and has an 18 in. cylinder, with ropes to convey the power to the places required; there are six ropes, each 5¼ in. in circumference. The rope-making machinery is by Samuel Lawson and Sons, Leeds, and consists of over twenty different pieces. The first machine is Good's patent for opening out the hemp fibre, and places all the threads parallel with each other as a continuous lever. These are taken to the first drawing frame, which much reduces the mass of fibre. The next is also a drawing frame. This frame makes it into two slivers, and these are deposited in tubs and taken to the spinning jennies, which makes the whole into yarn of various sizes, out of which the rope is made. The yarns are then wound on to bobbins, which are arranged in the rope-walk—a spacious hall some 1200 ft. long—and there formed into strands to make rope any size required. The inside and outside of these strands require the yarns to be of all different lengths; the machinery so arranges them that when the rope is made each thread bears its due proportion of the weight the rope is intended to carry. The ropes now being made measure from ¼ in. to 3 in. in diameter, but they can be made to any size required. The different pieces of machinery have borne a very satisfactory test, and with everything in his favour, there is little doubt that Mr. Laby will push a successful trade in the premises now termed the New South Wales Rope Factory. Amongst those who attended the opening were Mr. Abigail (M.L.A.) Messrs. Evans, Sayers, Power, Forsythe, &c. Mr. Laby entertained the party at luncheon. Mr. Abigail occupied the chair, and Mr. Forsythe the vice-chair. Several toasts were drunk. The Chairman proposed Success to the Firm of J. T. Laby, and in doing so remarked that when Mr. Laby came to this colony, 18 months ago, he thought there was an opening for starting a rope works, and instantly set about obtaining his machinery. He (Mr. Abigail) thought that those who inspected the machinery in the establishment that day—though he could not speak from professional experience—would come to the conclusion that he had certainly obtained a full supply of perfect machinery for the work he had just entered on. The cost was something about 12,000*l.*, and it spoke well for Mr. Laby's energy and enterprise for him to invest so much money in a business of that nature. He wished him every success in this colony, and he saw no reason why he should not be successful, for in a very little time he would have one or two hundred workmen located in that locality, and in doing that Mr. Laby would be promoting the best interests of this colony. There was only one thing he knew that would be against Mr. Laby, and that was the tax on the manufacture of rope. It was 8*l.* per ton in Victoria, 4*l.* in New Zealand; that was a very great stimulus to a man starting in the business in those parts; but it was only 2*l.* per ton at the present time in New South Wales.

Some time ago the Financial Secretary made a proposal to strike off even that sum; but the Members of Parliament resisted the attempt, and the tax now stands as before. If that 2*l.* had been taken off it would very materially intercept the success of Mr. Laby's new industry, and if any change took place in that matter at all it should be increased rather than reduced. Mr. J. E. Sayers also spoke to the toast. Mr. Laby replied. In the course of his remarks he said that that was undoubtedly a big undertaking for a man over 60 years of age to put before himself. However he would carry out the work of it to the best of his ability. The amount of rope imported last year to the colony of New South Wales was 966 tons, and if he could only get custom for one-third of that amount his business would be very successful indeed. He wanted to keep the work in New South Wales, and if he got the supplying of half the quantity of rope used in this colony the return for his enterprise would be considerable. Other toasts followed, and were responded to in appropriate speeches, and the party dispersed through the building to see the rope making apparatus at work.

Mr. Laby himself is a typical colonist—shrewd, kindly, and of indomitable energy, and I need hardly say enterprise also, and even without the small protection duty of 2*l.* per ton would still have gone into the venture, and trusted to his own talent to carry it through successfully.—*Sydney, Oct.* 29.

R. D. A.

AKANKOO MINING COMPANY.

SIR,—Referring to the Akankoo meeting, reported in the *Mining Journal* of Dec. 6, some of the remarks made by Mr. Maurice Grant in my absence demand a reply which I hope in fairness you will insert. The charge which Mr. Grant makes against the late board of "lavish expenditure" amounts to this—that when they took office, and I was appointed manager, one-fifth of the working capital (10,000*l.* out of 50,000*l.*) had been already spent in absolutely nothing that could assist in the development of the property, and to this the whole of the Cornish mining staff who have from time to time been engaged can bear testimony. This outlay of 10,000*l.* took place under the auspices with which Mr. Grant had launched the company, and how long the remaining 40,000*l.* would have lasted under the same system it is not difficult to guess.

The charge of "lavish expenditure" in the face of the work done will not bear honest examination. The total amount of capital outlay while I was manager did not exceed 35,000*l.* The country was when the work began a vast jungle; but in spite of unprecedented difficulties and a deadly climate the mine has been opened up, the necessary preliminary work done, and crushing has commenced within little more than 18 months from the time when a pick was first put into the ground. Mr. C. J. Harvey reported to the board in January of this year that after having "gone over the mine and works, the general arrangements devised for the development of the company's operations have my warmest approval." On the spot he expressed himself to the same effect even more strongly.

The boilers, about which so much has been said, were seen by Mr. Harvey without a single word of disapproval. I had steam up for several days before I left, with a pressure ranging from 60 to 80 lbs., and found no difficulty with them, nor did the engineer Andy, except such as arose from the weakness of the fuel, which the long-continued rains and floods had prevented us from drying or seasoning in sufficient quantity. They were vertical boilers (Coone's patent), and for nearly two years a smaller one of the same type has been used to drive a 42 in. circular saw, and has given complete satisfaction. Personally I prefer a Cornish boiler with large grate area, but at the time the boilers were ordered it was not believed possible to get such a boiler to the mine.

The last news I have from the manager, Mr. Louis, at the mine dated Oct. 18, is that "the mill itself runs beautifully, and gives no trouble at all. Since starting the 10 heads, in August, I have not once had to stop the mill for the mill itself, except to change grates; not a shoe off in all that time." He says nothing of the boilers leaking, but I may observe, *inter alia*, that without proper care the best boilers may be turned into leaky ones, or worse. Those who know the work and care involved in the erection of a 20-head stamp-mill, with 700 lbs. stamps in five stamp batteries will, I am sure, appreciate this; and, compared with it, the question of adding, if necessary, to the boiler-power is a minor one.

I have not had, like some gentlemen, 40 years' mining experience; but I have, during the last 10 years, made a special study of gold mining, and during a residence of many years in California have had the opportunity of closely inspecting a large number of gold mines and quartz mills, particularly in Bodie county. I say advisedly, as an engineer, that no better mill and mill-house have ever left England than that supplied for the Akankoo Mine.

The results per ton of the crushings hitherto to hand have not borne out the promises of the promoters, not an unusual thing I fancy in Mr. Grant's experience. So far as the title is concerned, the first intimation I had of the original one being unsound came from a colonial official, whose knowledge of the coast and standing was quite equal to Mr. Wyatt's.

Before Mr. Grant used the language he did, and expressed himself so confidently, he would have done wisely to ascertain not only what my knowledge of the matter was, but what credit attached in colonial circles to the source from whence he obtained his information, and to have borne in mind that a statement does not constitute a fact. He was as fully aware of all that I had done when he proposed a vote of thanks to me at the meeting of Nov. 30 last year as he is now. I am sure, momentarily at least, he means sincerely what he says, but I trust and believe that there will be some few who will not be more than momentarily misled.

Walbrook, Dec. 10.

EDMUND LANE,
Civil and Mining Engineer.

CALLAO BIS COMPANY.

SIR,—At the last meeting of this company the directors stated they would present the agent with 1000 shares of the company on his cutting the Callao lode. Now, Sir, as there is no indebtedness to him if he does so, as is only his duty, if it is there, I would enquire if it is not demoralising to make such a promise; for if in reality the Callao lode is cut as rich, when with comparatively little amount of skill he secures property which will enable him to retire—would it not have been better to reward him with a percentage on profits, thereby securing his doing his best exertions for the benefit of himself and the company whose interests he is entrusted with? And I doubt very much that the majority of shareholders were present when this was proposed but not commented on, as those present were too much occupied in wresting from the directors as many shares as they could obtain of the shares in reserve, and thereby to secure them to those who subscribed to the debenture fund. And if only a minority was present I doubt the legality of the proposed gift to an agent, the shares being the reserve stock of shares to fall back upon in case of need.—*Bristol, Dec.* 8.

F. SAWYER.

GIGANTIC RAILWAYS.

SIR,—When that enthusiastic Belgian—Mr. Jobert—proposed a railway for carrying passengers from Antwerp to Madras in 48 hours people thonght the suggestion preposterous; but the poor old gentleman has been put entirely in the shade as a projector by the Central American Railway scheme of Capt. Eads. It will be remembered that Capt. Eads had his neat little model made at London, and he is now exhibiting it in a kitchen, as you would call it on your side, in this city. For quality of workmanship the affair is, I guess, about equal to anything we could produce here; but it does not impress an American engineer—and we have some men of that profession who could keep a little of the sun out of your Great George-street in handling big things—with the idea that it would be a great engineering success, either professionally or financially. The exhibit comprises a ship model about 6 ft. in length; the pontoon and apparatus for lifting the ship and the carriage upon which it rests out of the water to a level with the permanent way; about 20 ft. of the permanent way, and a floating turntable which is to take the place of an ordinary curve. Owing to the length and rigidity of the carriage no curve of a radius under 20 miles is possible. There will have to be in consequence five of these floating turntables where changes of direction greater than this allowable curvature are to be made. The wheels have double flanges, and are attached to trucks, there being four wheels to the truck. Each truck receives its portion of the load, which will never exceed 20 tons, through the medium of four springs, which are each warranted to stand a load of 20 tons with a depression of 6 in.

A liberal estimate places the cost of the entire enterprise at $45,000,000. A few of the difficulties which the designers had to overcome were the following:—In the first place, a ship, with or without its cargo, has the greater part of its weight amidships. It would be impossible to construct any carriage of sufficient rigidity to transmit this weight equally to the numerous wheels upon which it is to rest. Thus, the wheels at either end, under bow and stern, would bear but little of the burden, while those in the middle would be crushed. To counteract this the weight of the ship, while on the pontoon, is supported by a system of hydraulic jacks. Under each end of the ship there is one jack, while, as the centre is approached, the number increases until there are five. The total area of the rams in each cross-row of jacks is the same, and, as they are all connected together and supplied by one force-pump, the pressure is equal upon each lineal foot of the carriage. According to the law of hydrostatics, that pressure on a liquid is transmitted equally in all directions. A second difficulty is that it is impossible to locate exactly the centre of gravity of a ship by calculation, and, even after an accurate location of that point, it would be difficult to bring it directly over the centre of gravity of the pontoon. But if these two centres are not in the same vertical line the pontoon will tip when floated, the guides will bind, and everything will come to a standstill. To prevent this there is an ingenious arrangement of hydraulic cylinders at the four corners of the pontoon, the ones at the diagonally opposite corners being connected, which will equalise the weight and absolutely compel the pontoon to preserve an erect position. After staying two weeks in this city the model will be removed to the New Orleans Exhibition.

Inventors are so habitually sanguine that it is merely waste of time to repeat their opinions; but to prevent English capitalists being misled with such a windy project, when there are so many rich mines which only require capital to make them return handsome profits, I should like them to understand the absurdity of his notion. Capt. Eads is sanguine that his railway will be made. Let me tell you, he says, that that railway will be constructed and in successful operation long before any vessels pass through the Panama or Nicaragua. I have spent $100,000 in surveying the Isthmus of Tehuantepec, and a syndicate of 60 of the wealthiest men in this country are interested in it, and represent more than sufficient capital to carry it through. The proposed railway will be about 134 miles in length. On the Atlantic side the route will begin on the Gulf of Mexico, and the Coalzacoalcos river will be utilised to Minatitlan, about 25 miles from the Gulf, in which the tide has a rise and fall of 18 in. only. From Minatitlan the route extends over an alluvial plain, on quitting which the line enters an undulating table-land, presently following a succesion of broad valleys, between which there are widespreading table-lands, the whole forming an extensive interior basin, bordered on its eastern and western sides by irregular mountain ranges, spurs of the main Cordilleras. From this basin the line passes through a valley to the plains of Tarifa, which constitute the summit level of the line, 736 ft. above low tide. Crossing these plains, the line reaches the pass of Tarifa, or Portillo. The line descends thence to the Pacific plains, reaching them by a uniform gradient, following a succession of valleys through the intervening hills. The maximum gradient required to reach the summit from either side is only 1 per cent., or 52·8 ft. per mile; but about two-thirds of the route will only require a gradient of about 20 ft. per mile. On the Pacific side there is a choice of two harbours—Salina Cruz and Boca Barra. In the latter the Pacific has a rise of only 5 ft.

But the great Belgian engineer was also sanguine. He propose

to run the present trains on the present railways as now, and merely to put a pair of outside rails of suitable strength just beyond the railway, and construct his locomotive and cars just so large that the present traffic could be carried on as at present beneath the axles. Jobert only proposed a minimum speed of 300 miles an hour, it is true; but he thought of dropping short journey passengers every 50 miles or 100 miles, and carrying them on by the present pigmy railways, at 50 miles or so an hour, to their exact destination. Hence a traveller would go from Antwerp to Constantinople in half-a-dozen hours, and continue his journey to some other part of Turkey by the present slow speed (50 miles an hour) trains at his pleasure. Now, when this scheme of Jobert's is in running order, any surplus funds might be handed over to Captain Eads. THOS. ARCHER.

New York, Nov. 25.

SOUTH STAFFORDSHIRE COAL, AND THE DEPRESSION IN TRADE.

SIR,—In these days of depression of trade, great failures, cry of poverty and starvation, it is pleasing that we have one class amongst us (well-known for their readiness to complain) doing well—the coalmasters. Of course, there are exceptions, as in all trades—for instance, those who have old collieries, troubles of water, heavy rents, royalties, drainage taxes, and bad coal; but those who have a fairly good mine are now in these evil days making—yes, coining—money faster than the mint. It will not be in good taste nor respectful to mention names, but we know collieries outside the Mines Drainage area—consequently free of that tax—working on moderate royalties, coal now selling at an average rate of over 8s. per ton, which does not cost, including every charge, 5s. per ton, doing about 1600 tons per week at an average profit of 3s. per ton, which, on 50 weeks, will give 12,000*l*. And if this is being done where rents and royalties are paid, I leave it for those who have the profit to enjoy it, and ask, What are those doing who have no such payments?

People ask, How is it that in South Staffordshire coal is selling at all times at so much higher price than in other coal districts? So much as to enable other colliery owners in Wales (North and South), North Staffordshire, Durham, Yorkshire, Derbyshire, &c., to bring their coal to Birmingham, Wolverhampton, and, more or less, to near all the great works in the Black Country.

Winter and summer coal and coke is imported by rail and water by thousands of tons, and the cost of delivery here serves as a protection duty to the colliery owners of South Staffordshire. And hence it is that colliery owners will ever be able to command much higher rates for their coal than is obtained in other coal fields; and as long as our manufacturers can pay the price the outsiders cannot wisely complain. As to closing the old collieries, which have contributed so much to the growth and wealth of South Staffordshire, which are contributing to our wants, it would have the effect of throwing thousands of poor men out of employment, and, to a fearful extent, reduce the amount paid in wages and put into circulation amongst the tradespeople. Again, we say, that of all the good branches of industry we know of in our district, none are equal in profit-making to a good colliery. As before mentioned, this has been seen and felt through all the bad times. P. B. P.

Wolverhampton, Dec. 1.

SMOKELESS HOUSES AND MANUFACTORIES.

SIR,—In his opening address at the Society of Arts Sir Frederick Abel appears to look on the practical realisation of the economical and smokeless use of fuel as yet in the dim future. He is doubtless as well acquainted as any living authority with the possibilities of gaseous fuel, but does not appear to be very sanguine of its general adoption by those to whom we owe our present smoke-polluted atmosphere.

I have never joined in the present agitation for the smoke abatement, for the simple reason that I have no faith in the present method of advocating it. I think I may claim, without egotism, to know something of the subject in some of its bearings, and in calling attention to the practical results obtained in my premises, I do not claim to have done anything wonderful, or to have made any brilliant discovery. As a matter of fact, I do not consider that any "brilliant discovery" is necessary for the realisation of a very great part of the programme of the advocates of smoke abatement, the means adopted being both rough, simple, and cheap. In my own house we have remaining one coal fire, which is occasionally used, but which will shortly be, like all the rest, done away with. We have 14 rooms, with hothouse and conservatory, and have used 4 tons of coal in two years; we shall probably not use 1 ton in the next 20 years, and we adopt the system we use because it pays and is convenient.

At the works, where we employ between 120 and 130 hands, using an ordinary steam boiler, hand fired, with engine, two blacksmiths' fires, and 16 tinmen's stoves, smoke is never seen, except for a few minutes when fires are being lighted; and to those who are sufficiently interested, I am prepared to demonstrate beyond question that smokelessness and economy, both in labour and fuel, may go together without any great expense or preparation in any way. The society has done me the honour to award me the Siemens' gold medal for the best application of gas to heating and cooking in dwellings; if they will offer another prize for smokeless works and dwellings, the cost to compare favourably with those of the smoke-producing order, I will at once put in my claim for it, based on the results of the last 12 months or more. THOMAS FLETCHER.

Warrington, Nov. 28.

THE LISKEARD DISTRICT—BICTON SILVER-LEAD MINE.

SIR,—I hear that the directors of the Bicton Mine are issuing more shares in order to increase their working capital to some considerable extent, as they intend to expend it in enlarging their present workings, and to further develope the resources of their splendid sett, where hitherto they have not done more than opened upon the backs of the lodes, and I wish them every success in both getting the capital and also in making good returns to those who may invest their money in the undertaking. They at all events will deserve it. It is really a good sett; it is well situated, being just at the junction of the granite hills of the Caradon district, and between that and the Kit Hills or Callington, with the killas or clay-slate formation, and situate in the valley between the two. The killas is of a very soft nature, and easily worked. The silver-lead lodes run north and south. There are four of them, as at present known, traversing the sett. One only has been worked upon to any extent, but it has yielded much silver-lead ores, of which many tons may now be seen on the floors, some ready for the market, and some large blocks undressed, as taken from the lode underground. Here I may mention a very important point in this lode. It has continued to improve both in quantity and quality of the ores from the adit to the deepest level (the 60 fm.), and now returns some splendid work. It is 9 ft. wide, and every good indication that is known in good silver and lead lodes are very fast developing themselves, and shows that by sinking deeper and developing the mine, the most satisfactory results will speedily be obtained by those who may be fortunate enough to invest in this mine. If even there were no other lodes close at hand, which there are, and some of them can be easily reached by driving short cross-cuts from the present levels, this one lode is very highly spoken of, and great returns are thought to be made from it by Capt. W. Harris, the managing agent, who is very sanguine indeed about the ultimate success of the mine, and I believe his opinions are upheld by the many mining experts who have from time to time made inspections of the mine in all its parts to the directorate.

There are two copper lodes also traversing this sett, and supposed to be of great value, and are considered to be a continuation of some of the justly celebrated South and West Caradon lodes, but as yet these have not been much worked upon, only on the backs and a grass shaft or two; but the indications and size of the lodes are very good indeed, as anyone can see who may visit the mine. And here again the manager thinks to find and make great returns of copper ores, and will, too, by the indications in sight when cut into from the deeper levels of the present working, and will make returns of immense value to the shareholders when properly developed. There are other splendid lodes of silver-lead just opened upon in this sett, which a description of I must leave to another time. If this mine is fairly worked I am fully persuaded that it will be a great thing for the shareholders and the public and the neighbourhood. G. S.

North Caradon, Dec. 9.

QUALITY STANDARDS FOR TIN-PLATES.

SIR,—If one can picture to himself the inconvenience that would result in England from the sudden abandonment of the Birmingham wire gauge without the substitution of any other recognised standard of measurement for wire, he will be able to understand something of the inconvenience which the ordinary buyer of tin-plates is put to in obtaining precisely the substance and quality of tin-plate he desires, unless he confines himself to trading with a single firm, and contents himself with "same as before," or "a little stouter than the last," or some other such indefinite instruction. Your readers will, therefore, comprehend the vast benefit the New York Metal Worker has conferred upon not only the American tin-plate trade, but on the Welsh also, in suggesting a definite classification, so that one may order a box of "AQ" terns, or a box of "GT" tin-plates, and know precisely what he is going to get. There are, as the Metal Worker very truly says, several leading features of tin-plates, or, to express it otherwise, several grades of quality possessed by the plates, irrespective of their coating, which every consumer readily recognises. For example, some plates will not even bend a square edge without more or less fracture. Yet these plates are useful for such purposes as the hoops of cans, the seams of which are soldered, and, therefore, there is good reason why they should be bought by manufacturers who have occasion to employ them. The next grade of plates, referring simply to the physical properties of the plate, without any reference whatever to the coating, may be described as capable of bending a square edge without fracture, yet having too little toughness to warrant grooving. A third grade may be described as capable of grooving, but will not double seam. A step still higher shows plates that may be double seamed if care is taken, while a still better grade of plates will double seam under all reasonable circumstances. Perhaps the highest quality that can be found in the market at present is indicated by successfully withstanding the strain caused by doubling the plate flat down upon itself and opening it out straight without a fracture.

With these different grades before him, from which to select in ordering, the consumer need have no difficulty in making known his wants. Instead of ordering Spread Eagle in the hope that it will double-seam, he disregards the brand, and says—"Send me a plate that will double-seam under all reasonable circumstances." On the other hand, when he requires a plate that will answer a satisfactory purpose in making up the bodies of cans, he desires something that is very cheap. In his order he says—"Anything that will form into a hoop, even if it does not have sufficient strength to make a square bend without fracture, will answer." From this it is evident that, after all, it is possible for the consumer to indicate his requirements in ordering tin-plates in such terms as are unmistakable. By care and precision in framing his order he can be sure of getting just what it is necessary to have, and there is no need to buy a higher quality nominally than is required in order to ensure practical working.

When it comes to a consideratton of the finish or coating of plates, there are several other points to be considered. For example, some bright plates are very cheaply coated, and are known in the market as coke finish. The coating of tin is of the thinnest possible character, and serves only to preserve the plate from rust and facilitate soldering in the process of making up into ware which is afterwards painted or japanned. Other plates may be described as having an ordinary surface, still others as having a fine surface, and others again as having an extra fine surface. Roofing plates have the same physical characteristics as we have already mentioned, and there are in the market plates having a light coating, others having coating of ordinary thickness, and still others the coating of which may be described as heavy. The coating of roofing plates may be more accurately indicated by the pounds of coating metal to the box. Several importers are putting out plates at the present time guaranteed to carry a specified number of pounds of coating to the box. In roofing plates the question is one of weight of coating rather than the finish of the surface. The consumer, therefore, in buying, taking into account both the quality of the plate and the nature and finish of the coating, words his order for bright plates as follows:—"Send me plates that will groove, and that are of fine surface," and for terne plates thus:—"Send me roofing plates carrying 15 lbs. of coating to the box. 14 × 20, and which will double-seam with care," or he describes other qualities he desires the plates to possess, as the case may be. From what has preceded it is very evident that the careful, thoughtful consumer has it in his power to indicate just what he requires, and if he is so fortunate as to deal with a house that is sufficiently posted in the qualities of the goods it handles as to understand his requirements, and know what plates will fill them, he can undoubtedly get what he wants, no matter how good or poor the plate may be that will meet his requirements.

It must be understood with regard to the subjoined table, which is printed with illustrations of the different kinds of rolls and bends in the New York Iron Age, that in the column indicating quality "A," indicates a plate that will roll, but will not bend a square edge; "C," a plate that will bend a square edge, but will not groove; "D," a plate that will groove, but will not double seam; "F," a plate that will double seam with care; "G," a plate that will double seam under all reasonable conditions; "H," a plate that will double flat and open without fracture; "J," a plate that will do for shallow stamping; "K," a plate that will bear ordinary stamping such as into bowls or patty pans; and "L," a plate that will do for deep stamping. The table stands thus:—

Quality of Plate	Kind of Coating and Finish of Surface.						
	Leaded or Terne.			Bright or Tin.			
	Light Coating. M	Ordinary Coating. Q	Heavy Coating. R	Coke Finish. S	Ordinary Surface. T	Fine Surface. V	Ex. Fine Surface. Y
A, will roll up	AM	AQ	AR	AS	AT	AV	AY
C, bend square	CM	CQ	CR	CS	CT	CV	CY
D, groove	DM	DQ	DR	DS	DT	DV	DY
F, double seam, with care	FM	FQ	FR	FS	FT	FV	FY
G, double seam, freely	GM	GQ	GR	GS	GT	GV	GY
H, flat and open	HM	HQ	HR	HS	HT	HV	HY
J, stamp shallow	JM	JQ	JR	JS	JT	JV	JY
K, will stamp	KM	KQ	KR	KS	KT	KV	KY
L, will stamp deep	LM	LQ	LR	LS	LT	LV	LY

It is explained that the coating of leaded or terne plates may be more accurately specified by giving the weight to the box. In such cases, follow the "M, Q, or R," as the case may be, with the number of pounds thus—"I C 14 by 20 F Q 12," or "I C 14 by 20 G R 18." The standards are upon the plan of using a letter of the alphabet for each of the more important qualities, both of the plate itself and the coating of the plate. The physical properties of the plate are given in the column at the left, while the different coatings and variety of finish which may be applied to it are in the headings of the columns to the right. In the squares at the intersections of the horizontal and vertical columns will be found the combination of letters designating both quality of plate and coating. Thus, a plate that can be depended upon to double seam, and which has a fine, bright, surface is indicated by GV. A quality designation of this kind is definite, and, therefore, very desirable for use in transmitting orders. Gauge and sizes of plates are to be given in addition, and in the usual way, as IC, IX, and 14 by 20, 20 by 28, &c. Wasters are designated by W. Particulars of a general nature, like "true gauge," "square trimmed," "absence of wire edge," "free of wasters," &c., are to be expressed in the usual way. The writer continues—If the reader has followed us this far, he will readily comprehend the scheme that we have had in mind all along when advocating the abolition of brands, and the substitution of quality specifications. While it is possible for the consumer to define his requirements without resorting to the use of brands, and that, too, much more specifically than is possible by depending upon brands alone, a better plan—or, at least, one more easily used than that explained above—may be employed. Supposing that each of the qualities of plate above described is indicated by a letter of the alphabet. Supposing, also, that the various coatings which are applied to the plates are also indicated by letters of the alphabet, all as described in detail in the above table. Then in ordering, instead of saying—"Send me a plate that will double seam under all reasonable circumstances, and which has a fine finish," the order would go, "Send me a GV," G, by the explanation given above, representing the first specification and V the second. In the case of terne or roofing plates, the weight of the coating to the box is added. For example—If a very fine quality of roofing plate is wanted, the order would read "GR 20," supposing that the plate was a 14 by 20, or "GR 40," in case it was a 20 by 28, R indicating terne coating, and 20 and 40 respectively the pounds of coating to the box.

We commend this scheme, which is explained in full elsewhere in this issue, to the attention of consumers of tin-plate generally. Every step in the reform which has been brought about in the tin-plate business has followed a demand made in the interest of and enforced by the consumer, and this is of really more importance than some which have preceded it. At the outset, in the agitation of this subject American importers derided the idea of any reform in their methods of business, and more particularly the introduction of plates of really good quality. In the short space of two years all this has been changed, and now prominent houses are competing with each other in the quality of their goods. Plates of indifferent quality with high-sounding names are out of date, and "old style" plates, guaranteed, are the rule. But, however satisfactory the state of the trade may be at the present time, there is need of still further advance. We lay this scheme before consumers with the suggestion that an extensive employment of it will be sure to bring its own reward. Importers of tin-plates, all of whom have had their attention called to it, will recognise these symbols, and, their meaning being unmistakable, they will fill orders to them. The general employment of this plan in sending orders will have the good effect of compelling importers to more carefully scan the quality of the plates they handle, and of making them familiar not only with the requirements of their customers, but also with those plates which most satisfactorily meet those requirements.

This plan of quality designations is of equal importance and value to importers and dealers. It renders guarantees much easier to formulate than ever before. It facilitates correspondence with consumers. To assert that a plate is "GR 40 New York Standards," for example, saves the writing of several lines in a letter which would otherwise be necessary to describe what it really is. It also facilitates telegraphic communications, and the symbols we have indicated in another column are a desirable addition to any telegraphic code. The plan can be advantageously employed also in placing importers' orders with makers, and in conducting correspondence with houses on the other side. In adjusting prices, plates which are strictly "GV," for example, are worth more than those which only grade up to "FT." In fact, considering the absence of all system whatever in grading plates, and the unmistakable standards which this plan affords, we incline to the opinion that it is really of more importance to the importer and manufacturer than to the consumer.

It is not improbable that some slight modification might be found necessary in adapting the standards to the views and requirements of the British manufacturers and of the British markets; but I think the readers of the *Mining Journal* will admit that we have here at least the nucleus of a rational system of classification, which might be imitated, if not adopted as it stands. You would, I am sure, be willing to afford space for the exhaustive discussion of objections, if any, which may be made; or for suggestions how the speedy introduction of the system, or of some modification of it, could be secured. With these remarks I leave the matter in the hands of the trade, with full confidence that they will not neglect it.

Liverpool, Dec. 8. HENRY BERGMANN.

MINING ASSOCIATION AND INSTITUTE OF CORNWALL.

The rules by which this combination of the Miners' Association and the Mining Institute of Cornwall are to be governed were adopted at a meeting at Redruth last evening. The Miners' Association and the Mining Institute now cease to exist as separate institutions. The adoption of the rules was moved by Mr. T. Pryor, and seconded by Mr. Bain. The Chairman (Mr. Frecheville) said a gentleman whose generosity and interest in the neighbourhood were well-known to them had been asked to accept the presidency of the new Institution—Lord Robartes—and his lordship had stated his willingness to fill the office. Lord Robartes was accordingly elected President unanimously. The vice-presidents appointed were the Rev. Canon Rogers, and Mr. R. J. Frecheville, Her Majesty's Inspector of Mines for Cornwall and Devon. The council comprise the past presidents of the two Societies, now amalgamated, who are *ex officio* members, and 20 ordinary members; the latter number, however, will be gradually reduced to 12. The *ex officio* members were—The Right Hon. Lord Falmouth, Sir H. H. Vivian, Robert Hunt, F.R.S., Sir J. St. Aubyn, Bart., M.P., A. P. Vivian, M. P. Warington, W. Smyth, F.R.S., G. L. Basset, W. C. Pendarves, W. C. Borlase, M.P., Dr. C. Le Neve Foster, the Rev. St. A. H. Molesworth St. Aubyn, W. Teague, Josiah Thomas, R. H. Williams, C.E., W. Husband, C.E., and J. Henderson, C.E. The ordinary members are—Messrs. W. Argall, W. Bickford Smith, J. L. Bolden, Charles Bishop, J. H. Collins, F.G.S., W. M. Grylls, F. V. Hill, Pearse Jenkin, A. Lanyon, Walter Pike, T. Pryor, J. T. Penrose, Wm. Rich, Wm. Rich, jun., G. J. Smith, Chas. Thomas, Lieut.-Col. Tremayne, W. Teague, jun., C.E., C. Twite, F.R.G.S., and W. T. White.

A paper "On the South or Main Tin Lode of Wheal Peevor" was then read by Capt. WHITE, who said he had had the supervision of the working on this rich tin deposit from commencement to close. The nature of the rock in which the lodes of Wheal Peevor district are embedded is clay, slate, or killas. Prior to the rich discovery former operations were carried on on the old north lode. He was appointed manager of the mine in March, 1876. They were then driving the 60 fathom level west, on the old north lode. This was poor for tin. This 60 end was not driving on the main part of the lode at that time, as was proved afterwards by driving a cross-cut north 4 fathoms, and so reaching it. Then the returns were very small, operations being carried on at a loss. A cross-cut was next driven south in the 60 *fm.* level, and in 6 fathoms driving they cut the south or main lode. From Feb. 14, 1872—when the present company commenced—down to the cutting of this lode the calls made amounted to 22,650*l*. At the point where the lode was first cut it was 2½ ft. wide, and the first sample gave 1 cwt. to the ton of stuff. In driving east from the cross-cut 4 ft. the lode was not more than 6 in. wide. In the whole 25 fathoms from the cross-cut to the shaft the lode appeared to be split into branches, and these branches did not form a junction until they got west of the cross-cut. And it was the junction that made the rich deposits, and probably if the cross-cut had not been driven this rich lode would not have been ever seen. From the cross-cut westward to the boundary—83 fathoms

—there was a continuous run of tin ground, the lode varying in value this distance from 10*l.* to 100*l.* per fathom, and in width from 2½ to 20 ft. When the lode was most productive the ground surrounding it would be of a stratified foundation, and the lode and country would be somewhat difficult to separate, having a "ragged wall" between the two. Another very congenial feature in connection with the ground was the light killas with white priany heads. He spoke of the branches which improved the lode, and which chiefly came from the old north lode. The majority of the branches which enriched the lode—coming in at an acute angle—had since been mainly worked away by the tributers. The general bearing of the lode was east and west, but in some parts of the drivage they found it varied a little from this, but when the lode was most productive it was, as near as possible, to the magnetic line east and west. In the four successive years that the mine returned dividends there were returned from this lode 2287 tons of black tin, realising at an average price of 40*l.* 16s. 3d. per ton 100,199*l.* The profit on this was 27,176*l.* At 14 successive meetings the sum divided amongst the shareholders was 26,025*l.*, or 8*l.* 13s. 6d. per 3000th share. The profits varied each 16 weeks from 603*l.* to 4916*l.* 16s. 3d., and the dividends from 5s. per share to 1*l.* 12s. 6d. per share. This successful working was carried on from April, 1878, to March, 1882, but, unfortunately for the company, a great quantity of tin was sold at a low price. The highest price they obtained in the last 16 weeks of 1878 was 34*l.* 5s. per ton, and the lowest 30*l.* 12s. 6d., and at that low price they made a profit of 855*l.* 6s. 4d. The average monthly return during these four years was 44 tons, and the largest quantity of tin raised during any 16 weeks was for the meeting held on Feb. 10, 1880, when 195½ tons was raised and sold. They had as high as 59*l.* per ton for a portion of this, and it was at this meeting that their largest profit was made. The chief portion of the stuff that produced the quantity quoted was stamped with 32 heads of stamps, which was another important fact in showing the rich character of the lode and the richness of the stuff it produced. At length Capt. White referred to the operations in respect of the lode, and asked who could say but that in depth in the western part of the sett they might not meet with more lodes?

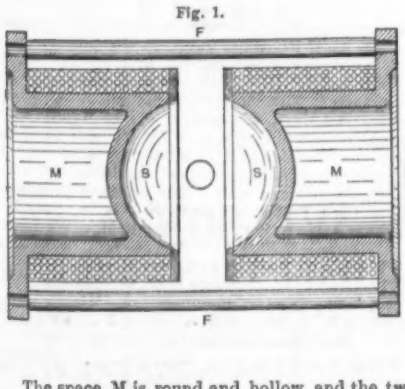
ELECTRIC LIGHTING IN AMERICA.

Electric lighting in this country has almost come to a standstill, at least as regards the lighting of our public buildings and streets; such, however, is not the case on the other side of the Atlantic. There electric lighting is in a flourishing condition, and it is estimated that there are probably as many as 90,000 lamps alight every night in the States, while the avenues and streets of the principal towns are almost entirely lighted by electricity. On Dec. 3 a paper was read before the Society of Arts "On Electric Lighting in America," by Mr. W. H. PREECE, F.R.S., an abstract of which is subjoined. The author having stated that it was with the arc lighting that the greatest advances had been made in the States, said that the principal systems in use were—for arc lamps, the Brush, Weston, and Thomson-Houston; but there were other arc systems not so well known on this side of the Atlantic, such as the Hochhausen, Van de Poel, Weston Electric, Fuller, Sperry, &c. For glow lamps the Edison and the Weston. The author continued to say that of arc systems the Brush was so well known that it scarcely needed any reference, except to point out that very considerable improvement has been made in the dynamo machine. A new armature, consisting of layers of thin sheet-iron insulated from one another, is in use, by means of which arrangement induced currents, which produce heat, are prevented from being formed, and now dynamos which with the old armature lighted 16 and 40 lamps respectively, with the new armature excite 30 and 65 lamps.

The Weston system, looked at from a mechanical point of view, appears to be the best in use in the States. The machine itself is of the Siemens form, but the armature is made up of discs stamped out of sheet-iron, and separated from one another by washers; the effect being, as in the Brush, to prevent induced currents, which by producing heat diminish the efficiency of the machine. Mr. Weston was the first to have carried out this very sensible and practical idea. The commutator in the Weston machine has no less than 140 segments, which tend to prevent "sparking," and in fact the absence of sparks is one of the striking features of this machine. There are standard Weston machines for working both arc and glow lamps. Both kinds are shunt wound, the former having a regulator which adjusts the strength of the shunt current, or field of magnets, so as to maintain the current in the main line constant. The 200-light Weston dynamo for glow lamps has a resistance of the armature of only ·0011 ohm, while that of the shunt is 24 ohms, thus having a ratio between them of 1 to 2182, the result of which is that the resistance of the armature may be neglected, and therefore the dynamo becomes self-regulating. The author saw 199 lamps out of 200 suddenly extinguished without producing any apparent change in the incandescence of the one glow lamp left. The electro motive force of this machine is 70 volts when rotated at 1000 revolutions per minute. The arc lamps of the Weston type are fed on the differential principle; but they owe their steadiness and good working to the perfection of workmanship and mechanical finish of their parts. The Thomson-Houston system, unknown at present in England, has some ingenious novelties. The field of magnets of the dynamo are of the peculiar shape shown in Fig. 1.

Fig. 2.

Fig. 1.



The space M is round and hollow, and the two parts are strongly bolted together with 18 bars of soft iron F. F., leaving a spherical space S for the field. The armature, Fig. 2, is spherical, and almost entirely encased by the field magnets; the magnetic field thereby becomes enclosed, and is very intense. The dynamo is series wound. The commutator consists of only three sections, and there are two pairs of brushes. It has an automatic governor which keeps the current steady. To prevent undue sparking at the brushes there is a peculiar air blast device which blows out the sparks which would form at them. A point of considerable importance is that the arrangement admits of the free oiling of the commutator. The ordinary size Thomson-Houston dynamo lights up 25 arc lights, and has 225 lbs. of copper on the armature, and 700 lbs. on the field magnet. It has an electro-motive force of 1200 volts when rotated at 900 revolutions per minute, and generates a current of 9·8 ampères in the lamp circuit.

The lamps have an average resistance of 4·5 ohms, and the electric motive force that each lamp requires is 45 volts. A 25-lamp circuit absorbes 23·25-horse power. The commercial efficiency of this machine is, therefore, 80 per cent. The Hochhausen system from its recent employment at the International Exhibition, at the top of the high mast, is slightly known in this country. It is doing a large business in America. The author went on to say that he had visited the central station of the Thomson-Houston Company at Montreal. There were 164 arc lights in the public streets and shops; the wires through the town were copper, No. 6 gauge, covered with cotton and asbestos and were carried through the streets on unsightly posts. The rate charged is 50 cents per night, from dark to midnight, equal to 35*l.* per lamp per annum. It has been decided to light the streets of Ottawa entirely by this system. The central station of the Brush system was also visited at Philadelphia, where 1200-horse power was employed in supplying the electricity for nearly 1000 lamps. The charge is $25 per month, or about 60*l.* per lamp per annum.

At Boston the Brush people have two central stations lighting up 816 arc lamps, and few towns of any consequence are without this system. At Chicago over 2000 arc lamps are going, belonging to different companies, and they are increasing every day. The author did not observe a single instance of street lighting with the glow lamp. Arc lamps are universally used, and are arranged on posts about 50 yards apart in zig-zag fashion. An experiment was tried at Cleveland, where eight Brush lamps were fixed to the tops of four iron masts about 250 ft. high, placed in prominent positions in the City, but the author thought the effect very poor, the streets being only illuminated as by a pale moonlight. At New York the price paid is 70 cents per night, or 50*l.* per annum for each arc lamp, but a fine is inflicted on the lighting company of $1·40 each time the lamp goes out; a healthy check is thus kept on the good working of the system.

Incandescent lighting in America does not seem to have flourished to the same extent as arc lighting, nor has it been applied to private houses to the extent it has been in England. The Edison is the principal system in practical use, but Mr. Weston has recently introduced some incandescent lamps that promise to be very efficient. These latter are made from a material called "Tamidine," the result of some secret process upon nitro-cellulose, which is rolled out into very thin sheets, and the filament is stamped out of it in a wavy form by dies. Carbon is deposited upon this filament until it acquires a standard resistance, and the process is self acting, so that great regularity is maintained in the resistance of this filament. The Swan lamp is extensively used, and the Bernstein lamp, a new one, is also getting a footing in the States. The Edison Company have devoted their attention to house lighting. They have a central station at New York, which since its opening Sept. 3, 1882, has only had two and a half hour's stoppage, that being due to carelessness. There are 587 subscribers, using 12,764 lamps, but the present arrangements of the company are quite inadequate to supply all the applicants who desire light. Although the price charged is low the system is worked at a profit, and the earnings during the past 12 months would have warranted the payment of a dividend at the rate of 3 per cent. on the invested capital, but as yet no dividend has been declared. The earnings per lamp per hour are 1·04 cents, and cost of production for same time ·75 cents. The Board of Trade unit is equal to 1000 watt-hours, and an Edison 16-candle lamps absorbs 80 watts; therefore, 12·5 lamps alight for one hour would consume a Board of Trade unit. These lamps would cost in New York 15 cents for that time, and, therefore, the charge made is equivalent to 7½ per American B. T. unit. The average number of hours of lighting comes out at 2·4 per day, and the average life of each lamp is about 477 hours.

The consumption of coal per lamp is ·82 lbs. per hour, and there are five lamps per horse-power. The average number of lamps per subscriber is 21, and amount paid 40*l.* per annum. A too free use of fuses, bad joints to conductors, and leaks in the mains have been the principal difficulties met with. The current is distributed by double mains, involving the use of an immense weight of copper. Dr. Hopkinson and Mr. Edison have shown an economy of 60 per cent. in the weight of copper used can be effected by using three wires and two dynamos. It is intended to open two more central stations in the upper part of New York, when, with the experience gained, the troubles met with at the old station will be remedied. At Roselle the author saw 1200 lamps used supplied by three dynamo machines joined up in a series; the lamp also being worked in three series. Overhead wires were used, and the charge was 1 c. per hour for each 10-candle lamp, equivalent to gas at $2·5 per 1000 cubic feet. At Brockton there was a central station wired up on the three-wire system: 2090 lamps were going, and 1040 about to be started. The station was opened October, 1883, with 250 lamps, the rate charged 1 c. per hour for each 10-candle lamp. There were 108 subscribers, and although a dividend has not yet been earned the receipts balance the expenditure, and with the business growing as it is a handsome balance ought to be realised at the end of the second year.

The author also inspected two large central stations in New York, worked on the Weston high tension system, one of which worked 384 arc lamps, the other 500 arcs and 1750 glow lamps. He was of opinion that not less than 7½ per cent. should be allowed for depreciation, but in no case did he find more than 5 per cent. allowed, and in some cases the allowance was only 2½ per cent. With regard to conductors, with the exception of the Edison system, they were all aërial wires, generally of copper covered with cotton or hemp. The high tension currents are used. Much trouble has been caused by the powerful electric light currents finding their way into telephone and telegraph circuits by contacts, no less than seven fires in offices could be traced to this cause. At Chicago the Town Council have refused to give permission to the Edison Company to lay their wires underground, consequently they have not a station there.

The form of secondary batteries most generally in use is that of Mr. Brush, a modification of Planté's cells. Another modification of the same by Dr. Starr is in use at Philadelphia. The positive plates were composed of a solid frame of lead filled with thin inverted V plates, arranged herring-bone fashion, the interstices between which were filled with lead shavings. The author said he had devoted considerable attention to the instruments for measuring purposes, especially the practical working of Edison's method of measuring the currents by the electrolytic action of a small portion of the current upon two zinc electrodes immersed in a solution of sulphate of zinc. The measurements by this system are undoubtedly based on accurate formulæ, and if all the conditions are fulfilled the results must be perfectly true. Each meter contains two bottles containing the solution and the zinc electrodes. They are examined every month, and the plate which has suffered loss of zinc is removed, dried, and carefully weighed. The mean between the two measurements is taken as the true one, and the weight of zinc lost, in milligrammes, multiplied by a co-efficient, gives the number of dollars to be charged for the light consumed during the month. The consumers themselves have taken various steps to check the reliability of the meter returns, and the result has been that the public has gained confidence in the accuracy of the measurements and the charges made. Electric lighting is much used on the magnificent steamers that ply between New York and the Fall River and others.

The problem whether electric lighting is practical, and whether it can be made to pay, has been solved in the United States. The mistake made in England has been to attempt to enter into competition with gas. Electricity must earn its future success on its merits, and not on its economy. Although we regard the electric light in this country as a luxury, there is no reason why it should always remain a luxury. The author went on to point out that there was still vast room for economy, and that prices now paid for the light must not be regarded as final. He concluded by pointing out its moral effect in disturbing the haunts of those who infest most great towns and cities, and who render the streets of London at night a disgrace to modern civilisation.

In the course of the discussion which followed, Mr. Hammond said that certainly the Americans had gone very much farther ahead than we had in this matter, but it was very desirable to draw the correct lessons from what was to be seen there. It was not entirely due to want of enterprise that England was behind America in this. One great point was the price of gas, which was much dearer in America than in England. Again, many of these contracts in America, though they might not involve any loss, did not show any profit. There were cases where good profits were being made; but that was in localities like Salt Lake City, when people had plenty of money to spend, and where gas was 17s. a thousand. The Americans looked upon the light as an advertisement. A man would for the sake of outshining his rival put the most flickering arc light outside his door, and his experience was that the American arc lights were far behind our own. Again, the heat was great in America, and whilst in England some people liked the warmth of gas, in America no one would go to an hotel not lighted with electricity, if there was one which was opposite. He referred to the number of overhead wires in New York, and said such a state of things would not be tolerated in England. He was sure the Americans would eventually find it better to put the wires underground. He spoke of the restrictions placed on English companies putting wires underground, how that they had to apply to Parliament. As they had urged upon Mr. Chamberlain the other day, why should not the local authorities be empowered to grant liberty to any company in whom they had confidence to put wires underground? The great lesson to be learnt from America was that it could be done. There were hundreds of thousands of people ready to pay double the price of gas for the electric light, but capitalists were constantly saying they were told it could not be done. Mr. Edison had shown in New York that incandescent lighting could be supplied from a central station, and that when done on a large scale the risk of failure was infinitesimal. In New York they were able to make a small margin of 3 per cent., using five watts per candle, getting 7s. 9d. for it, and paying three-fourths for the manufacture. In England it could be produced with three watts per candle, at a cost for manufacture of 3s. 8d., instead of 6s. If in New York they could make 3 per cent. on a capital of 200,000*l.*, which included an immense amount sunk in experiments, they might hope in England to make 8 per cent. on a capital of 70,000*l.*, which would be sufficient, with proper plant and the advantage of further experience, and by working at three-fifths the cost they might even hope to make 12 per cent.

Mr. Preece said he had not much to reply to, and he was pleased to find that the paper had not elicited much opposition. First, with regard to overhead wires he would say that if he were to live 50 years in Philadelphia he should never become satisfied with these overhead wires. They were hideous in the extreme, and the only advantage he had found for them was that they afforded a welcome shade from the fierce glare of the sun. But it was not necessary to go to America for them; in Brighton they were carried overhead, though not in the unsightly fashion which so disfigured the streets in the United States. In one place in New York he had counted 144 wires on one post, and in Broadway there were six distinct lines of posts going down the street, there being 32 separate companies in that city carrying wires on poles. There was no necessity for it at all, for it was found by the Post Office that, whenever the number of wires through a town exceeded 15, it was cheaper to put them underground than overhead; and he was quite certain that when the people in America came to their senses this plan would be adopted. With regard to the meters, he said there was no doubt that in the first 12 months considerable difficulties were experienced in the use of the meters, but now they had become more familiar these difficulties were avoided, and the meters were certainly working well. Meters on the same principle were also in use at Brighton, where there was a central station serving a great many places with the electric light. It was done in spite of this wretched Act of Parliament, and even without the consent of the local board. A gentleman in the room, who was somewhat imbued with the American spirit, Mr. Hammond, went to Brighton and established a central station, from which he supplied the Grand Hotel, the Orleans Club, and many other places, in spite of the objectionable Act of Parliament and the local board, and he used meters of the same principle to regulate his charges.

THE ROYAL SCHOOL OF MINES.

The twelfth annual dinner of the professors, students—past and present—and others connected with and interested in the Royal School of Mines, was held on Dec. 5, at the First Avenue Hotel, High Holborn.

The chair was occupied by Mr. F. W. HARMAN, who was immediately supported by Prof. W. Smyth, Dr. Geikie, Prof. Judd, Prof. Frankland, Prof. Huntington, Prof. C. Roberts, Prof. Goodeve, Prof. Wrighton, Major Macgregor, Dr. Hodgekinson, and Messrs. Best, E. Matthey, R. Smith, Tookey, W. H. Greenwood, Howes, Danby, Postlethwaite, and others. In all there were about 100 present.

The CHAIRMAN, whose rising was the signal for hearty cheering, in brief but well chosen terms, proposed the health of Her Majesty the Queen, and the other members of the Royal Family. Speaking from a lengthened experience in many parts of the world, he could testify to the loyalty with which this toast was honoured by his countrymen, whatever the particular character of their surroundings, and he felt sure it would meet with a no less warm reception on the present occasion.

The CHAIRMAN said it afforded him considerable pleasure to propose the next toast on the list—that of the Army and Navy. On many occasions he had received the greatest hospitality from members of both services—an experience common no doubt to most of those present; and he was sure they were all pleased at the opportunity of paying their little tribute to the admirable manner in which Her Majesty's forces were now working together at that moment in Egypt.

Major MACGREGOR briefly responded, and in doing so observed that though his connection with the School of Mines was very limited, it had been long enough to convince him that the agreeable qualities of its representatives were no less marked than the serviceability of the institution as an educational establishment.

The CHAIRMAN next remarked that the pleasant task now devolved upon him of proposing the health of their Dean—their very worthy Dean—Prof. Huxley. No words of his could, he was sure, adequately describe how strong was the hold possessed by Prof. Huxley upon the hearts of scientific Englishmen in general, and upon the students of the Royal School of Mines in particular. Wherever they went they heard his name mentioned with respect and admiration, and everyone was proud of being in any way connected with him. Prof. Huxley favoured these annual gatherings with his presence whenever he was able to do so, and it was only his absence from England which prevented him being among them that evening. He felt sure all present would join with him in drinking his health very heartily, and in wishing that he might soon recover his health, and return to take his place among them as before.

Mr. HOWES, who has been for some time past closely associated with Prof. Huxley in certain of his labours, acknowledged the compliment, mentioning with pleasure the fact that he had just received a note from Prof. Huxley giving a satisfactory account of his improved state of health.

Mr. POSTLETHWAITE, in proposing the health of the Past and Present Professors, said fortunately the toast was one that did not require any eloquence to secure for it at the hands of those present a favourable reception. Taken as a body, he did not believe that a better set of men could be found than the professors of the Royal School of Mines, whether they were regarded for their intellect, their knowledge, their powers of hard work, or their amiability. It was a matter of great national importance, in view of the prominent position occupied by the mining and metallurgical industries, that the Royal School of Mines should be governed by men of the highest standing. This necessity became all the greater when note was taken of the immense efforts put forth by other nations to compete and even beat this country in the race for pre-eminence in this department of science. Among past professors the names of Tyndall and Ramsay held a leading place, while the list of present professors, with Huxley at their head, was almost too numerous to go through.

Prof. WARINGTON SMYTH, whose name had been coupled with the toast, responded. It was, he said, with the greatest satisfaction, and, at the same time, a considerable amount of diffidence, that he accepted the responsibility of returning thanks for the living representatives of—omitting himself—a very eminent body of men. It had afforded him much pleasure and satisfaction to welcome their Chairman that evening after many months of absence, and after a long and arduous journey. This circumstance brought out with special prominence the thought that they who had laboured during many years past to impart to those under their charge the best knowledge in their power had much cause to feel thankful that so many of the old students returned safe and well to this country after occupying admirable positions in various parts of the world. Many of the students of the School of Mines had gone forth into the world, and had worked with honour and distinction in some of the remotest parts of the earth, returning home, after more or less lengthened absences, to reap and enjoy the approval due to honest and able services. For instance, Mr. Blandford had come back from the heights of the Himalayas, and from the vast plateaus of Abyssinia; and Mr. Drew had returned from the heights of Cashmir, while other men had more recently distinguished themselves on the American continent, both north and south. Among these latter mention might be made of Mr. Jacob, who had come home from North America armed with the most remarkable collection of geological maps and sections, prepared under the superintendence of Dr. Emmons, relating to the region round Leadville, which averaged a height from 11,000 to 13,000 ft. above the sea. He had had the satisfaction of discussing with Mr. Jacob his experiences among these remarkable elevations—experiences he need scarcely add of the most deeply interesting character. Then, lastly, but by no means least of all their former students who had won for themselves high places in the world of practical science, they had with them that evening Mr. Rathbone, who had just come back from those most remarkable heights of South America—the Potosi Mountains—where he had carried on explorations at a height of from 13,000 to 14,000 ft. above sea level, and whence they might hope that rivers of silver would again flow as they did of yore. At other times the necessities of their positions had taken them down great depths, but whether in one direction or the other the result had been the same—admirable contributions to the common stock of scientific knowledge, and to the development of commercial activity. Of one thing he was quite confident, and t was that everyone concerned might feel an assured pride in all the work carried out by the students of the School of Mines. On returning from the performance

of their various duties, these men, one time students of the school, had brought back with them something that was better than specimens, something that was even better than their own good health—and that was a high and untarnished reputation. Further, he might state that he had never met among those capitalists who had employed the students of the School of Mines for making explorations abroad, nothing but the most unqualified satisfaction with the work that had been done for them. Any discussion of the subject in detail would lead to the drawing of invidious comparisons; but he could not help resting emphatically on this point—that among the number of disappointing and distressing enterprises that had been brought before capitalists in London, in no one case, as far as his knowledge went, had the name of any ex-student of the school been connected therewith. He was able to look back over a good many years of activity in connection with the school, and he might observe, concerning his colleagues, that they had not attempted to carry out the duties of their respective positions until they had gone through a good deal of hard work themselves. The endurance of hard work and indomitable perseverance were the two great essentials necessary to a student in the acquisition of knowledge which should fit him to take rank as an expert in mining and metallurgical matters. He had had the happiness of rowing for two years in the University crew, and he believed the good effect wrought on muscle and wind was only exceeded by the good effect produced on the mind. The determination never to say die proved of invaluable aid to a man in overcoming the difficulties and trials of life. The feeling that so often prompted a man to exclaim, "Oh, better give it up," if resolutely fought against would undoubtedly end in the successful accomplishment of the presumably impossible task. In conclusion, the speaker referred to the spirit of good fellowship, and of honourable behaviour which had grown up among the students, and which, developing into a sort of *esprit de corps*, prevented them, when labouring in the world at large, from doing anything mean or dishonest. Looking to the vast and important interests involved in the mining and metallurgical industries of this and other countries, the getting together of a body of men such as he had described was, in itself, more than sufficient reason for the foundation, 34 years ago, of the Royal School of Mines.

Mr. T. W. DANBY, in proposing Prosperity to the Royal School of Mines and to the Mining and Metallurgical Industries, said he rose in submissive obedience to superior orders, and he did so in great trepidation. He very much regretted to say that personally he had no practical connection with either of these two great industries. Of their value to the kingdom, to the empire, and to the world at large no one could, for a moment, entertain any doubt; and great as that value was, he found it was steadily increasing. In 1851, when the memorial had been first urged on the Government to found a School of Mines, the value of the annual mineral production of this kingdom amounted to 28,000,000*l.* sterling, being four-ninths of the entire production of Europe. Now, by last year's returns the value of the mineral products of Great Britain amounted to 56,000,000*l.* sterling, showing an increase of cent. per cent. Irrespective of this fact—that these industries were at the base of their national prosperity—they possessed a romantic interest from their lengthened and close association with the progress of civilisation. It was a metallurgical product, first, in the form of the highly-tempered blade of the Roman soldier, and, latterly, in that of the "almighty dollar" in the hands of the irrepressible trader, which had aided the cause of development, and moved the wheels of progress. Every feature of civilisation spoke eloquently of the potent influence of metals. For the sake of the myriad toilers by the furnace and in the mine they ought heartily to wish prosperity to these interests. It would be difficult to overrate the excellent qualities displayed by the men active and enterprising in this sphere of labour—the fortitude, no less than the admirable temper they displayed, when, as it too often happened, the mine became the miner's grave. While speaking on the subject of the prosperity of these industries it was impossible to overlook the fact that whereas in 1876 the assessment for the purpose of income tax as regarded mines and ironworks represented the sum of 21,000,000*l.* sterling, last year the sum total amounted to only 9,000,000*l.* It was but small consolation to say that they suffered in common with other countries; but a lesson for their future guidance might be drawn from a comparison of the circumstances of all cases coming within their purview. And, certainly, this fact was at once noticeable and unquestionable—that the mining industries best flourished where the masters made the largest and most consistent use of the appliances of science. Bearing this truth in mind, he could not too strongly impress upon his hearers the value of the benefits they enjoyed in the instruction given at the School of Mines, the advantage of which they would feel in their subsequent careers. Commending the toast to their warm acceptance, he had great pleasure in coupling with it the name of Prof. Roberts.

Prof. C. ROBERTS, in responding, observed that the Royal School of Mines, like every other body which had enjoyed a prolonged existence, must necessarily comprise two very different sets of men—those actively engaged in carrying out the work of the institution, and those who are just entering upon the course of studies that its curriculum afforded. The most important question which arose in connection therewith was, What had they, the old men, to say to the younger? Now, the answer to such an enquiry must of course in great measure depend upon the industrial condition of the country at that particular time, because the prosperity of the men at the School of Mines was closely bound up with the material prosperity of the nation at large. He wished he could say that the prospects of the mining and metallurgical industries were good; he might, however, venture the opinion that they were slightly better than before. But if the period of commercial leaps and bounds had passed away for ever, they might at least hope much from the increase of population and the opening up of new markets. Still the question remained, could they, the old men, honestly say to the new, that the profession they had chosen held out as good prospects as any other they could have selected? He honestly answered that he thought they could so say. His recent journey across the Continent of America had greatly enlarged his horizon, while at the same time furnished him with fresh ground for belief in the future of the profession. During his trip he had had the pleasure of meeting Rush, of Yale College, Richard Pearce, of Boston Academy, Denver, and the Prices, father and son, of San Francisco, and he brought them greetings from each and all. Regarding the school from the point of view of the younger men, he should say, judging by the athletic clubs and other societies that had started up within the boundaries of the institution, there was no falling off whatever in the character of the students who would have to sustain the honour of the school in the future. Regarding the school on the other hand, from his own point of view certain slight developments would, in his opinion, suffice to place it on a footing equal to that of any in the world. And now that he had had an opportunity of seeing most of the mining schools of Europe and America, he was in a position to speak, and he could say confidently that these joint institutions offered would be students the best professional instruction to be found anywhere. But one other word in conclusion. They were in all a large body of men, and widely scattered; they wanted some bond of union such as had been formed in France by the establishment of the *Ecole Polytechnique*, and he ventured to suggest that they should resolve upon uniting themselves into a body, under the presidency of Prof. Warington Smyth, devoted to the advance of the professional interests of the students of the Royal School of Mines. They would in that way form a body of men of wide sympathies, but moved by this special object—care for their own professional interests. For his own part he was quite sure that the old bonds were no whit stronger than the new. Devoted as he was to the past history of the school, its future prospects were equally dear to him; and though he had the privilege of teaching among them now, he should never forget that he was one time a student of the Royal School of Mines.

Mr. R. SMITH proposed the health of the Old Students, who he said always held the memory of the institution where they had received their professional training in pleasant remembrance.

The toast having been duly honoured, Mr. E. MATTHEY briefly responded. Although it was now nearly 30 years since he had matriculated at the Government schools in Jermyn-street, it gave him the very greatest pleasure to come among the present representatives of the body at these annual gatherings. As an old student of the schools who had seen not a little of the rough side of life in the world at large, he heartily commended to the consideration of those present Prof. Smyth's words concerning hard work and endurance. It was those traits in the national character which had raised this country to its present pinnacle of greatness, and which would no less affect its fortunes in the future.

Prof. JUDD submitted the toast of the Geological Survey, and he reminded those present of the close relationship which bound that institute with the School of Mines. Concerning one particular phase of that connection, it might be noted that while many students had gone forth from the School of Mines, and assisted in the work of the Geological Survey, it was to the maps and charts of the Survey that they had to look to see the way that geological work should be done in this country.

Dr. GEIKIE, Director-General of the Geological Survey, responding to the toast, observed that since the "younger son"—the School of Mines—had had an establishment of its own it had grown so much, and developed such wide sympathies, that it was, he thought, very kind indeed of it to remember the relationship that existed. It was melancholy to look back upon the old links that had become broken in the course of time; one, however, still existed in the person of Prof. Warington Smyth, who remained, he supposed, as a remarkable illustrative example of the truth of the Darwinian principle of the survival of the fittest. It was due to the School of Mines to say that it had trained up some of their best surveyors; while from time to time their strength was recruited by students from this institution. On first making the acquaintance of Sir R. Murchison he had been asked "Can you walk?" For a moment he could not understand the enquiry, but Sir Roderick went on to explain that legs were nearly as much use to a geologist as a head. There was, of course, a great deal of truth in that remark; though he might add that while they could make some use of a man without any legs, they could not make any use of a man who had no head, and every day the necessity for a head grew in importance. With the immense advances made by science in recent years a great deal more than physical endurance and "an eye for the country" were needed, and he knew of nowhere where that all necessary scientific training could be better obtained than at the School of Mines.

Mr. PINCHEON proposed the health of the Visitors, and urged the benefits accruing from social gatherings like the present. A few months since the question had been very hotly discussed "What shall we do with our sons." He would suggest that no better plan could be adopted than turning them into mining engineers.

The toast having been drunk, Mr. JAMES responded. Although this was the first occasion on which he had had the pleasure of meeting the students of the School of Mines as a body, he had frequently met them individually in various parts of the world, and had received many kindly services at their hands. After to-night his only regret would be that he had not had the pleasure and privilege of being trained in the School of Mines.

Dr. WOODWARD (of the British Museum) also acknowledged the compliment, and in doing so wished the school a like measure of success in its new quarters at South Kensington as it had enjoyed in the old.

Prof. GOODEVE next proposed in very happy terms the health of the Present Students, and the Committee. Dating from to-night "Excelsior" it seemed was to be the motto of the school; and he did not doubt that the gentlemen whose health he was now proposing were destined to occupy very elevated positions in the world. He was sure those present would concur in the opinion that the committee were entitled to their very heartiest thanks.

The toast having been heartily honoured, Mr. T. S. TREVOR responded, and said speaking on behalf of the committee that they had been amply repaid for any trouble which they had taken in the matter by seeing so many old students assemble to do honour to the occasion. Moreover, the very appearance of those old students afforded tangible evidence of the success they had achieved in the profession, and in that way gave every encouragement to those only just entering on the career of mining engineers.

Mr. SEYMOUR had great pleasure in proposing the health of the Chairman, who, distinguished in many arts, was no less honoured as the apostle of conviviality.

The CHAIRMAN having briefly acknowledged the compliment the proceedings were brought to a close.

The Nerbudda Coal and Iron Company directors on Tuesday declared an interim dividend of 1s, 3d. per share, payable forthwith.

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CAPITAL HALF SUBSCRIBED.

MACHINERY IN HAND TO LEAVE WITH STAFF IN JANUARY.

FEW SHARES LEFT.

See *Mining Journal*, Nov. 15, 1884, "On Prosperous Gold Mining Enterprise," and Nov. 29, 1884, "Ball Gold Syndicate—No. 3," page 1397.

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MANUFACTURERS OF

THE VAUXHALL DONKEY PUMPS.

THE EXCELSIOR DIRECT-ACTING PUMPS.

Air Compressors.

Winding Engines.

HOISTING MACHINERY.

ILLUSTRATED AND PRICED CATALOGUES ON APPLICATION.

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GEOLOGICAL MAP OF CORNWALL:

By BRENTON SYMONS, C.E., F.C.S.

A handsome SKETCH MAP, printed in FIVE COLOURS, and showing the Geological Formation, the Direction of the Lodes, and other useful details. Will be forwarded on receipt of remittance.

MINING JOURNAL Office, 26, Fleet-street, E.C.

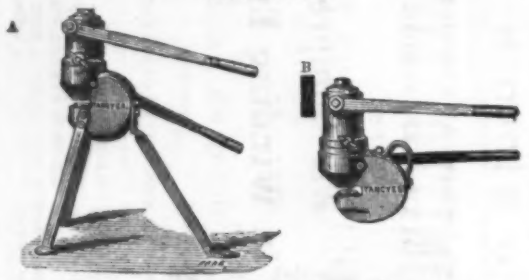
TANGYES LIMITED, CORNWALL WORKS, BIRMINGHAM.

LONDON: 35, Queen Victoria Street. **NEWCASTLE: St. Nicholas Buildings.** **MANCHESTER: Deansgate.** **GLASGOW: Argyle and Hope Streets.**

(No. 17.)

TANGYES' HYDRAULIC PUNCHING BEAR.

OPEN MOUTH.



This Bear is made in two forms—viz., with legs as A, or with handle instead of legs, as B. The latter is largely used by Shipbuilders for punching ship frames, &c.

Distance from centre of punch to back of gap is 1¾ in. For extra depth of gap special quotation is necessary.

No.	To punch.	Through iron plate	Weight.	Price.
1	¾ in.	½ in.	94 lbs.	£ 7 10
1A	13/16 ,,	⅝ ,,	90 ,,	9 0
2	1 ,,	¾ ,,	120 ,,	10 10
3	1¼ ,,	1 ,,	320 ,,	21 0
4	1 ,,	steel rails	320 ,,	34 0

Price includes one Round Punch and Die.

PUNCHES AND DIES FOR HYDRAULIC AND SCREW BEARS.

To punch hole ... in.	⅜	½	¾	⅞	13/16	⅞	1	1¼	1⅜
Through iron plate,	⅝	¾	⅞	1	1	1	1	1	1
Round ..... per pair	4/-	5/-	6/-	6/-	6/6	7/-	7/6	10/-	
Oval or square ,,	8/-	10/-	11/-	12/-	13/-	14/-	15/-	20/-	

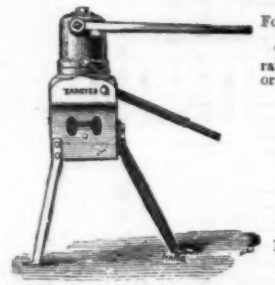
A Pair means One Punch and One Die.

Intermediate sizes charged at price of next larger size.

144

TANGYES' HYDRAULIC PUNCHING BEAR,

CLOSE MOUTH.



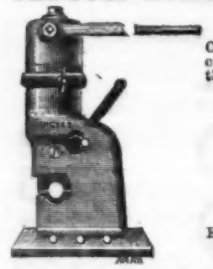
For IRON or STEEL RAILS, GIRDERS, &c.

This Bear is made to suit any section of rail. In ordering, send a piece of the rail, or a full-sized sectional sketch.

No.	To punch.	Through iron plate.	Price.
1	¾ in.	½ in.	£12
2	1 ,,	¾ ,,	17
3	1¼ ,,	1 ,,	28
4	1 ,,	steel rails	38

Price includes one Round Punch and Die.

TANGYES' HYDRAULIC STEEL CABLE SHEARS.



This Tool was specially designed for cutting Steel Cables, which it does very effectively, making a clean cut. It may be used also for Shearing Iron Bars in the usual way.

No.	To cut iron bar.	To shear Steel Cable.	Price.
1	2 in. × ½ in.	1¼ in. diam.	£28
2	3 in. × ¾ in.	2 in. ,,	35

Price includes one pair Blades.

Extra Shear Blades per pair, No. 1, £2; No. 2, £2 10s.

PUNCHES AND DIES FOR HYDRAULIC AND SCREW BEARS.

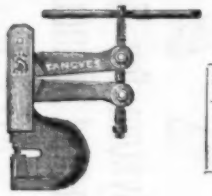
To punch hole ... in.	½	¾	¾	13/16	⅞	1	1¼	1⅜
Through iron plate ,,	¾	⅞	1	1	1	1	1	1
Round ..... per pair	4/-	5/-	5/6	6/-	6/6	7/-	7/6	10/-
Oval or square ,,	8/-	10/-	11/-	12/-	13/-	14/-	15/-	20/-

A Pair means One Punch and One Die.

Intermediate sizes charged at price of next larger size.

145

TANGYES' "DUPLEX" LEVER PUNCHING BEAR.

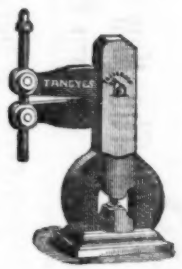


This Bear is now made almost entirely of Steel.

OPEN MOUTH DUPLEX BEAR.

No.	To punch.	Through iron plate.	Gap.	Weight.	Price.
1	½ in.	¾ in.	1½ in.	18 lbs.	£ 3 10
2	¾ ,,	⅞ ,,	1½ ,,	36 ,,	4 10
3	15/16 ,,	⅞ ,,	2 ,,	81 ,,	6 10
4	⅞ ,,	⅞ ,,	2½ ,,	120 ,,	10 10

Price includes one Round Punch and Die.



CLOSE MOUTH DUPLEX BEAR.

No.	To punch.	Through.	Price.
1	1½ in.	¾ in. iron rail	£17 10
2	1¾ ,,	⅝ ,, steel ,,	

Price includes one Round Punch and Die.

PUNCHES AND DIES FOR HYDRAULIC AND SCREW BEARS.

To punch hole ..... in.	½	¾	¾	13/16	⅞	1	1¼	1⅜
Through iron plate ,,	¾	⅞	1	1	1	1	1	1
Round ..... per pair	4/-	5/-	5/6	6/-	6/6	7/-	7/6	10/-
Oval or square ,,	8/-	10/-	11/-	12/-	13/-	14/-	15/-	20/-

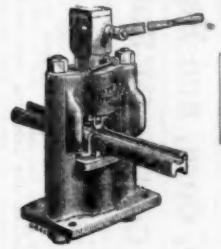
A pair means one Punch and one Die.

Intermediate sizes charged at prices of next larger size.

147

TANGYES'

STANDARD HYDRAULIC PUNCHING MACHINE.



No	Gap.	To punch.	Through iron plate	Weight	Price.
1	8 in.	1 in.	⅝ in.	4 cwts	£25
2	12 ,,	1 ,,	1 ,,	7 ,,	30
3	21 ,,	1 ,,	1 ,,	10 ,,	38

Price includes one Round Punch and Die.

TANGYES' SCREW PUNCHING BEAR.

No.	To punch.	Through iron plate.	Weight.	Price
1	½ in.	¾ in.	22 lbs.	40/-
2	¾ ,,	⅞ ,,	36 ,,	50/-
3	15/16 ,,	⅞ ,,	51 ,,	75/-

Price includes one Round Punch and Die.

If with Ratchet Lever, extra 12/-

,, Plain ,, ,, 3/-

PUNCHES AND DIES FOR HYDRAULIC AND SCREW BEARS.

To punch hole ..... in.	⅜	½	¾	⅞	13/16	⅞	1	1¼	1⅜
Through iron plate ,,	¼	⅜	½	⅝	¾	⅞	1	1	1
Round ..... per pair	4/-	5/-	5/8	6/-	6/8	7/-	7/6	10/-	
Oval or square ,,	8/-	10/-	11/-	12/-	13/-	14/-	15/-	20/-	

A pair means one Punch and one Die.

Intermediate sizes charged at price of next larger size.

146

TANGYES' HYDRAULIC PULLING JACK.

In this Jack the Pump is inside and out of the reach of damage from accident.

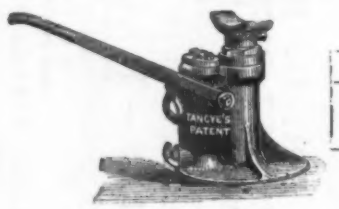
The run out can be increased to a moderate extent without increasing size of cylinder.

Tested to .....tons	2	4	6	8	10
Run out ..... ins	24	24	24	24	24
Weight ..... lbs.	60	70	90	120	180
Price ..... £	9	11 10	14	18	18
Extra run out, per ft.	60/-	60/-	70/-	80/-	80/-

INSTRUCTIONS FOR USING THE PULLING JACK.

After filling it with water, which can be poured in through the air screw, suspend it with the cistern end downwards, screw up the stop valve and work the hand lever; the water will then be pumped from the cistern through the inner tube to the underside of the piston, thus impelling it forward, and at the same time the water from the back of the piston is constantly flowing through the passages indicated to supply the cistern. TO LOWER, open the stop valve, when the water will return to the cistern.

TANGYES' HYDRAULIC TIMBER JACK.



Tested to	4 tons.
Height	14 in.
Run out	7 ,,
Weight	76 lbs.
Price	£4

142

TANGYES' HYDRAULIC SHEARS.

No.	To cut Iron square or round.	To cut Iron Bar.	Price.
1	1½ in.	3 × ½ in.	£16 0
2	2 ,,	4 × ¾ ,,	21 10

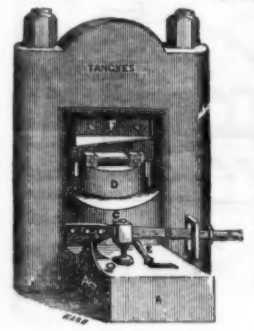
Weight: No. 1,—230 lbs.; No. 2,—380 lbs.

Extra Shear Blades per pair, No. 1, £2, No. 2, £2 10s.

These Shears can be adapted for power by attaching a joint pin to end of lever.

HYDRAULIC SHEARING MACHINE,

(Eastwood's Patent)



No.	To cut Iron square or round.	Price.
1	2½ in.	£42
2	3 ,,	50
3	3½ ,,	65
4	4 ,,	90

All with 10 in. gap, and two Pumps.

If made with separate Pump to be worked by power, extra.

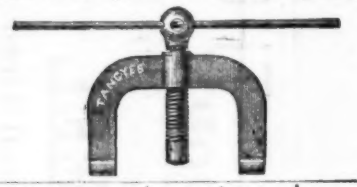
If mounted on wheels extra.

143

TANGYES'

SCREW RAIL BENDER, OR "JIM CROW."

Made of best hammered Scrap Iron. Machine-cut Square Thread Screw.



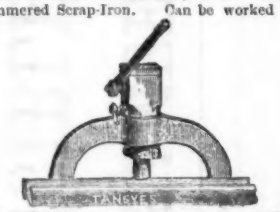
Size ..... No.	1	2	3	4
Price ..... £	2 10	3 10	5 0	7 0
Diameter of Screw	2 in.	2¼ in.	2½ in.	2¾ in.
Span	16 ,,	20 ,,	24 ,,	24 ,,
To bend Iron Rails up to, pr.yd.	30 lbs.	50 lbs.	90 lbs.	—
,, ,, Steel Rails ,, ,,	20 ,,	45 ,,	65 ,,	90 lbs.
Weight.....approx.	60 ,,	96 ,,	140 ,,	180 ,,

This Bender can be made to suit any section of Tram Rail.

TANGYES'

HYDRAULIC RAIL BENDER, OR "JIM CROW."

Made of best hammered Scrap-Iron. Can be worked in any position.



Size.....	A	B	C
Price ..... £	7	9	11
To bend Iron Rails up to .....per yard.	50 lbs.	90 lbs.	—
,, ,, Steel Rails ,, ... ,,	45 ,,	65 ,,	90 lbs.
Weight..... approx.	100 ,,	150 ,,	200 ,,

This Bender can be made to suit any section of Tram Rail.
When ordering, a section of the rail should be sent.

148

TANGYES'

HYDRAULIC SHAFT STRAIGHTENER,

For Straightening Shafts in the Lathe.

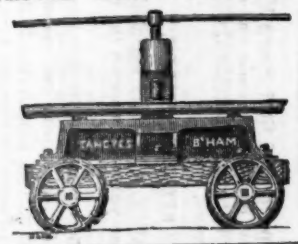
A bar passing through an eye in each of the Straps, not shown in engraving, is supplied for convenience of lifting the machine, by means of Pulley Blocks, on and off the Lathe.

Diam. Ram.	Will take Shafts.	Weight.	Price.
3½ in.	3 in. diam.	2 cwts.	£16
5 ,,	4 ,,	3½ ,,	23
6½ ,,	5 ,,	6 ,,	30

Price includes Straps.

TANGYES'

IMPROVED RAIL STRAIGHTENER.



No.	To bend Steel Rails.	To bend Iron Rails.	Price.
1	45 lbs. per yd.	60 lbs. per yd.	£18
2	90 ,, ,,	90 ,, ,,	25

In ordering state gauge of rails, or if required for roads.

149

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Of the MOST APPROVED AMERICAN PATTERNS.

GOLD MILLS.

The California pattern of Gold Stamp Mill is universally accepted as the most perfect, economic, and efficient made.

We have over 900 stamps in successful work in the various Western Gold Districts.

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Silver amalgamation in Pans is essentially an American system evolved after years of work on the rich silver mines of Nevada.

We have over 500 Stamps, with necessary pans, settlers, roasting furnaces, &c., all of our own manufacture, at work in different silver camps of the United States, Mexico, and South America, and Phillipine Islands, Asia.

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Of the most approved German pattern and arrangement, or with Stamps and Frue Vanner Concentrators for low grade silver ores, light in lead. We have over 20 large German pattern mills at work on lead, zinc, or copper ores, and numerous Vanner mills on ores never before successfully concentrated.

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We have 80 Water Jacket Smelting Furnaces in use from 20 in. circular up to 54 in. by 60 in. for lead and silver smelting; and special High Jacket Furnaces for copper ores.

Engines of any size, plain slide valve, Corliss, compound Corliss, Boilers, all sizes. **Leaching Mills, Hallidie Wire Rope Tramways. Comet Crusher,** with capacity of 12 to 20 tons per hour. **White, Howell. Bruckner, and Stetefeldt Roasting Furnaces, &c.**

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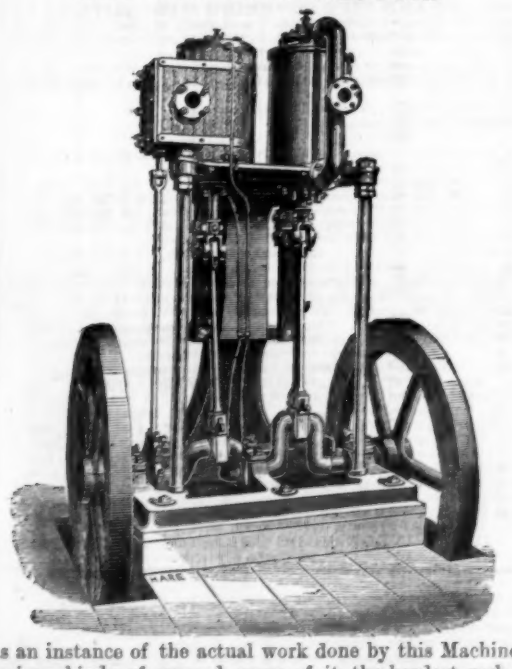
THE

"Champion" Rock-borer

AND AIR COMPRESSOR.



As an instance of the actual work done by this Machinery in various kinds of ground, some of it the hardest rock, it may be mentioned that in Cornwall, irrespective of the work performed by the "Champion" Rock-borers and Air-compressors purchased by various Mines, the drivage, rising, sinking, and stoping done by contract by the Proprietor with his own Machinery now amounts to over 1400 fathoms.

Several of these Air-compressors, ranging from 3½ to 12 tons in weight may be seen in constant work in the Camborne Mining District.

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KIRKSTALL, BOWLING, AND STAFFORDSHIRE BAR IRON

RAILS—RAILS—RAILS—

New, slightly defective.

F.B. SECTION—BULL HEAD—DOUBLE HEAD—

10, 12, 14, 16, 18, 20, 24, 30, 40, 50, 60, 70, 75, 80 lb. per yard.

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2000 tons in stock ready for delivery.

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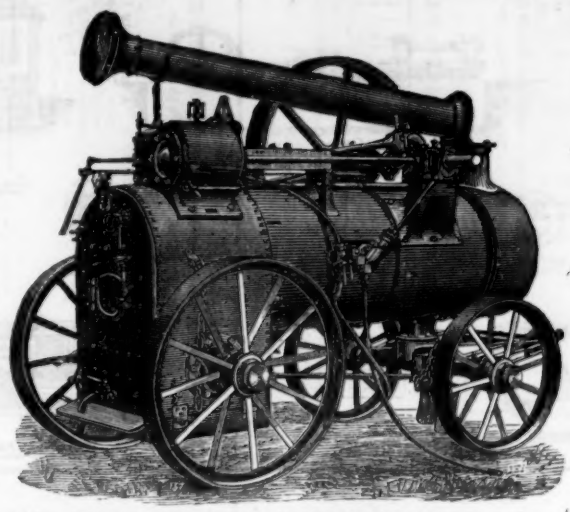

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SHEAF WORKS, AND SPRING WORKS, SHEFFIELD.

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Potentite does NOT contain its own MEANS OF IGNITION, is free from Nitro-Glycerine, and its SAFETY has been speciall demonstrated by public experiments.

Its strength is unequalled. Its action is certain.

In action it gives off neither flame, smoke, nor offensive smell. By its use labour is economised, as work can be resumed immediately after the shot is fired.

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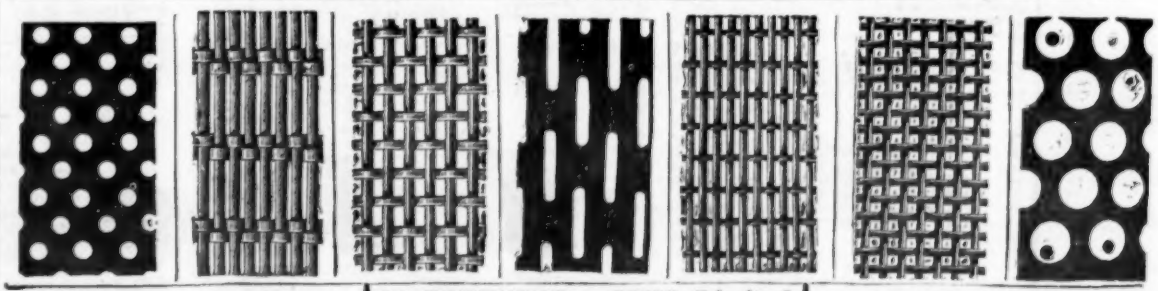

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Made in all Meshes and Widths.

N. GREENING & SONS, Limited,

Wire Manufacturers and Metal Perforators,

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Jigger Bottoms, Trommels, Cylinder Covers, Riddles, Sieves for Diamond, Gold, Silver, Copper, Lead and Tin Mines.

Samples and Prices free on application.

FRANCIS MORTON AND CO., LIMITED, LIVERPOOL,

MANUFACTURERS OF

GALVANISED CORRUGATED IRON ROOFS, BUILDINGS, AND SHEDDING,

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GALVANISED OR PAINTED CORRUGATED IRON ROOFING PLATES and TILES. HEAVY CORRUGATED IRON PLATES for fireproof floors, roadways, parapets, &c. (for producing which F. M and Co. have recently laid down powerful Hydraulic Machinery). Wrought-iron Tanks, Guttering, and General Constructional Wrought Ironwork.

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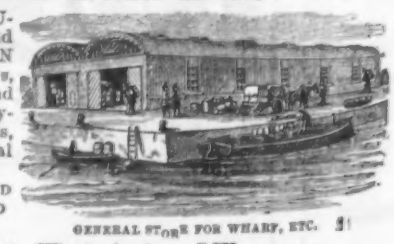

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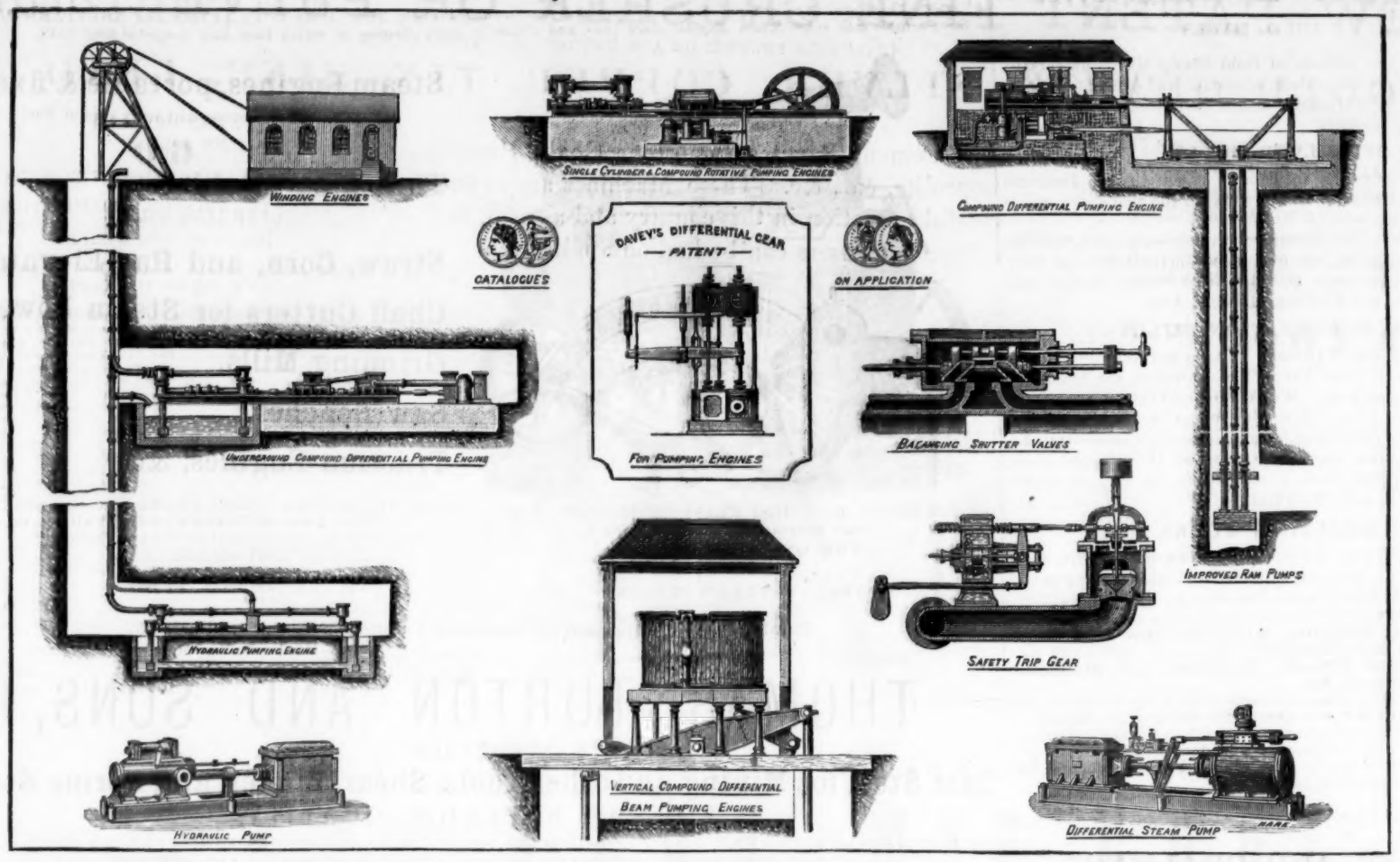

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BELL'S ASBESTOS.

BELL'S PATENT ASBESTOS BLOCK PACKING for High-Pressure Engines

The following testimonials refer to this Packing:—

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2nd August, 1884.

DEAR SIR,—I have much pleasure in answering your note. Bad times in mining have compelled me to try all kinds of expedients in order to effect saving; some have succeeded and some have failed, but my underground manager, Capt. Hughes, has just said to me by the telephone—"The Asbestos Packing is the best thing ever brought here."

It saves money and trouble, but like my gas purifying oxide it lasts so long that you must not expect another order from me for twelve months at least.

Yours truly,
T. F. EVANS,
Late H.M. Inspector of Metalliferous Mines.

Mr. J. Bell.

Manchester, Sheffield, and Lincolnshire Railway—Steamship Department,
Grimsby, April 10th, 1884.

DEAR SIR,—I have much pleasure in stating that after a trial of over nine months, and comparing it with other packings, I can confidently recommend your Asbestos Packing. It is especially valuable when high-pressures are employed, as in cases where other packings have perished, owing to high temperatures, your packing has invariably stood well. I have also used it with complete success when a gland has heated with other packings, and also in cases of badly scored piston rods. I consider the results I have obtained by its use for our marine engines to have been in every way highly satisfactory. Yours truly,

Mr. J. Bell. G. H. CLARKE, Sup. Engineer.

Department of the Director of Navy Contracts,
Admiralty, Whitehall, 20th June, 1884.

SIR,—I have to inform you that your tender has been accepted for Bell's Rolled Cloth Asbestos Packing to sample submitted:—Elastic core ... ... Square.
" " ... ... Round.

To Mr. John Bell. JOHN COLLETT, Director of Navy Contracts.

The Patent Block Packing is square, as Fig. 1 and Figs. 2 and 3 represent the Round Block Packing with solid and hollow rubber core, and Fig. 4 without core, but with rubber inlaid. As these packings are extensively imitated, and as it is a common practice among dealers and agents to supply the cheaper manufactures at my list prices, users are requested to see that the packing supplied to them bears the trade mark.

BELL'S ASBESTOS BOILER PRESERVATIVE.—This useful mixture by absorbing the free oxygen that is in the water entirely checks pitting and corrosion. It also disintegrates incrustation so immediately as to prevent its adhering to the plates. Not only is a great economy of fuel effected by keeping boilers clean, but the risk of having the plates burned is thereby obviated. It has been computed that 1/16 in. thick of incrustation causes a waste of 15 per cent. of coal; 1/4 in., 60 per cent.; 1/2 in., 150 per cent. Thus the Preservative avoids the great risks which are inseparable from scaled plates, lengthens the life of a boiler, and covers its own cost a hundredfold by economy of fuel. It is entirely harmless, and has no injurious action on metals. It can be put into the feed tank or boiler, as may be most convenient. Sold in drums and casks bearing the Trade Mark, without which none is genuine.

BELL'S ASBESTOS YARN and SOAPSTONE PACKING for Locomotives and all Stationary Engines running at very high speed with intense friction. Sandwell Park Colliery, Smethwick, 1st February, 1884.

To Bell's Asbestos Works.

DEAR SIRS,—I have much pleasure in stating that I have used your Asbestos Packing for the last 13 months for our large winding engines which are running night and day, and also for the fan, pumping, and hauling engines at the above Colliery, and during that period we have not used more than one-third the Packing we had formerly; and this I attribute to your Packing on account of its great durability and general excellence of quality.—I am, dear Sirs, yours faithfully,
THOMAS WINTER, Colliery Engineer.

TRADE MARK.

BELL'S ASBESTOS.

The goods of this house are of the highest quality only, and no attempt is made to compete with other manufacturers by the supply of inferior materials at low prices. All "home" orders should be sent direct to the undermentioned depôts and not through Agents or Factors.

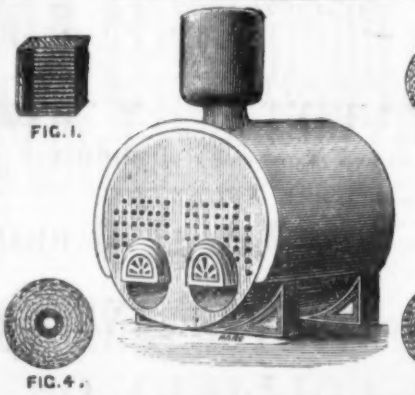


FIG. 1.

FIG. 2

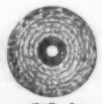


FIG. 4.

FIG. 3.

BELL'S ASBESTOS BOILER AND PIPE COVERING COMPOSITION, for coating every class of steam pipes and boilers, non-combustible and easily applied when steam is up; adheres to metals and preserves them from rust; prevents the unequal expansion and contraction of boilers exposed to weather; covers 50 per cent. more surface than any other coating, and is absolutely indestructible. It can be stripped off after many years' use, mixed up with 20 per cent. of fresh, and applied again. The composition is supplied dry, and is only to be mixed with water to the consistency required for use.

A Horizontal Boiler, 17 ft. 6 in. long, 15-H.P., gave the following results:—

Temperature on Plates - - - 186 deg.
" " Covering - - 94 deg.

One ton of coal was saved per week, and although the fire was raked out every evening 20 lbs. of steam were found in the boiler next morning.

The following Testimonials refers to this Covering:—

Offices of the Wimbledon Local Board, Wimbledon, Nov. 28th, 1883.

DEAR SIR,—It may interest you to know that we save exactly 40 per cent. in fuel through using your covering. Yours truly. W. SANTO CRIMP, C.E., F.G.S.

The Tamar and Kit Hill Granite Company (Limited),
Mr. John Bell, Southwark, S.E. Gunnislake, Tavistock, 8th April, 1884.

SIR,—I have much pleasure in stating that the Asbestos covering applied by you to the boiler of our travelling crane at Kit Hill has yielded most remarkable results. Since it has been in use we have saved fully half our coals, and have effected a great saving in the time it takes to get up steam, which is often a matter of great importance to us. I should add that the crane runs on high gantries, and is fully exposed to all weather. I have formed the highest opinion of your Asbestos as used for this purpose, and as you are aware, have had another boiler similarly covered, though it has not since been used. I can most strongly recommend the material.

I am, Sir, yours faithfully, W. J. CHALK, Assoc.M.Inst.C.E., Engineer and Manager.

BELL'S ASBESTOS and INDIA-RUBBER WOVEN TAPE and SHEETING, for making every class of Steam and Water Joints. It can be bent by hand to the form required without puckering, and is especially useful in making joints of manhole and mudhole doors. It is kept in stock in rolls of 100 ft., from 1/8 in. to 3 in. wide, and any thickness from 1/16 in. upwards. Manhole covers can be lifted many times before the renewal of the jointing material is necessary. The same material is made up into sheets about 40 in. square, and each sheet bears the Trade Mark, without which none is genuine. It is very necessary to guard against imitations of this useful material, and to secure themselves against being supplied with these inferior articles at my price, users are recommended to see that every 10 ft. length of the Asbestos Tape purchased by them bears the Trade Mark.

BELL'S SPECIAL LONDON-MADE ASBESTOS MILLBOARD, for Dry Steam Joints, made of the best Asbestos fibre, is well-known for its toughness and purity, and is absolutely free from the injurious ingredients frequently used to attain an appearance of finish, regardless of the real utility of the material. Made in sheets measuring about 40 in. square, from 1-64th in. to 1 in., and 1/2 millimetre to 25 millimetres thick. Each sheet bears the Trade Mark.

The following copy of acceptance of tender refers to above:—

Department of the Director of Navy Contracts.
Admiralty, Whitehall, S.W., 17th May, 1884.

SIR,—I have to inform you that your tender for Asbestos Millboard has been accepted.—Mr. John Bell. JOHN COLLETT, Director of Navy Contracts.

BELL'S ASBESTOS EXPANSION SHEETING (PATENT). This Sheeting is another combination of Asbestos with India-rubber, giving to the steam user the special advantages of both materials. The India-rubber Washer is protected from the action of heat and grease by an outer coating of vulcanised Asbestos Cloth, thus producing an excellent joint where expansion and contraction render other materials unserviceable. This material is admirably suited to steam pipe joints and every class of valve. Valves made of this material are very durable, as they are not subject to injury by oil.

BELL'S "ASBESTOS LUBRICANT."

"REGD"

ILLUSTRATED PRICED CATALOGUE FREE ON APPLICATION TO

BELL'S ASBESTOS WORKS, SOUTHWARK, LONDON, S. E.

OR THE DEPOTS—118a, SOUTHWARK STREET, S.E.,

Victoria Buildings, Deansgate, MANCHESTER. 11 and 13, St. Vincent Place, GLASGOW. 39, Mount Stuart Square, CARDIFF. 21, Ritter Strasse, BERLIN.

THE BLAKE-MARSDEN NEW PATENT IMPROVED STONE BREAKERS AND ORE CRUSHERS.

ORIGINAL PATENTEE AND ONLY MAKER

H. R. MARSDEN,

ALSO PATENTEE AND ONLY MAKER OF THE

NEW PATENT FINE CRUSHER OR PULVERIZER,

FOR REDUCING TO AN IMPALPABLE POWDER, OR ANY DEGREE OF FINENESS REQUIRED,

GOLD QUARTZ, SILVER, COPPER, TIN, ZINC, LEAD

AND ORES OF EVERY DESCRIPTION

PATENT REVERSIBLE CUBING and CRUSHING JAWS, IN FOUR SECTIONS,

WITH PATENT FACED BACKS, REQUIRING NO WHITE METAL IN FIXING.

CRUCIBLE CAST-STEEL CONNECTING RODS. RENEWABLE TOGGLE CUSHIONS, &c.

OVER **4000** IN USE.

EXTRACTS FROM TESTIMONIALS.
PULVERIZER.

"I have great pleasure in bearing testimony to the merits and capabilities of your patent combined fine crusher and sieving apparatus. I have tried it on a variety of ores and minerals, and it pulverizes them with equal success. You can put in a small paving stone and bring it out like flour."

"In reply to your favour, I have much pleasure in informing you that the 12×3 Pulverizer we had from you is giving us every satisfaction. The material we are operating on is an exceptionally hard one. I am well satisfied with its working."

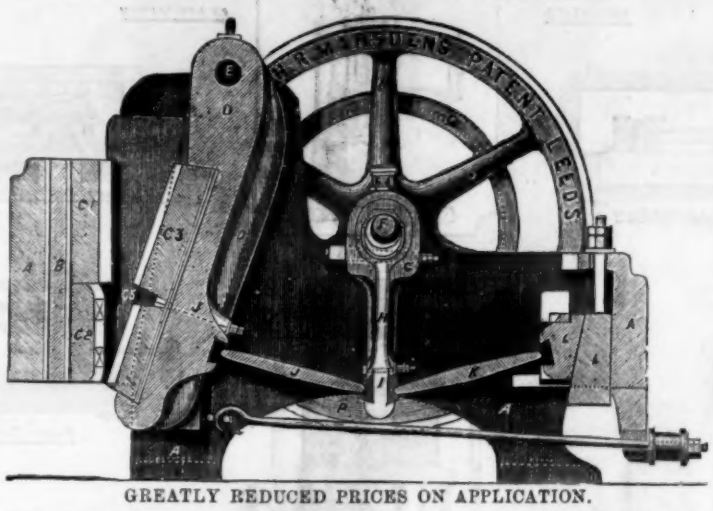
"Our experience is that the motion and mechanical arrangements of your machine are the best for pulverising that we have ever met with."

"The reports from our mines as regards the working of your Fine Crusher (20×5) recently supplied are very favourable, although we cannot quote you exact figures. On being got into position it was tried *by hand*, with the result that it made short work of the biggest pieces of ore we put into the hopper. You might say how long you would take to deliver another of the same size."

"As I once before stated, your machine is a perfect pulverizer."

"I am sure the machine will be a success, and a great one, and there is any amount of demand for such a machine. We can work it with 20 lbs. of steam, and our engine, which is a 12-h.p., plays with the work, in fact we run the Stonebreaker and the Pulverizer both together with 35 lbs."

Also Cement, Barytes, Limestone, Chalk, Pyrites, Coprolite, &c., &c. These Machines are in successful operation in this country and abroad, and reference to users can be had on application.



GREATLY REDUCED PRICES ON APPLICATION.

AWARDED OVER

60

FIRST-CLASS GOLD AND SILVER MEDALS.

ADOPTED BY THE PRINCIPAL CORPORATIONS, CONTRACTORS, MINING COMPANIES, &c., IN ALL PARTS OF THE WORLD.

ROAD METAL BROKEN EQUAL TO HAND, AT ONE-TENTH THE COST.

EXTRACTS FROM TESTIMONIALS.—STONEBREAKER.

"I now order Three of your Stone Crushers, size 15 × 10, to be of your very best construction, and to include two extra sets of Jaws and Cheeks for each. The last two 24×13 machines you sent me, which are at work in this colony, are doing very well. You will soon find that the railway contractors will adopt your machines in preference to the colonial ones—two of which I have. I know other contractors have had as many as nine of them, which have not given very good satisfaction. Once they know of yours thoroughly, I believe you will do a good trade with the colonies. For reference of the high character of your constructions you can refer to me as having used them with the very best results, both in New Zealand and this colony, and much prefer them to the colonial article, both in point of construction and less liability to go out of order. The material we are crushing is very hard blue stone, for railway ballast purposes. Push on with the order as quickly as possible; I do not think it necessary to have any engineering inspection. I have brought your machines prominently under the notice of all large contractors in this colony, likewise the Government. Many of the contractors have spoken to me in reference to their capabilities, and I could only tell them that they are by far and away the best and most economical I ever used. The very fact of me having purchased now Eleven from you at various intervals and various sizes, and two above 12 years ago, and having tried all the other makers, is sufficient guarantee of the capabilities and the working of your machines. Yours in every way surpass all others."

"Some of your testimonials do not give your machines half their due. I have seen men hammering away on a big rock for a quarter of a day which your machine would reduce to the required size in a quarter of a minute. I would guarantee that your largest size machine would reduce more of the Cornish tin capels (which is the hardest rock of England) n a day than 200 men, and at 1-25th the cost."

FOR CATALOGUES, TESTIMONIALS, &c., APPLY TO THE SOLE MAKER,

H. R. MARSDEN, SOHO FOUNDRY, LEEDS.

JOHN CAMERON'S

SPECIALITIES ARE HIS

STEAM PUMPS

FOR

COLLIERY PURPOSES.

Specially adapted for forcing Water any height

ALSO, FOR

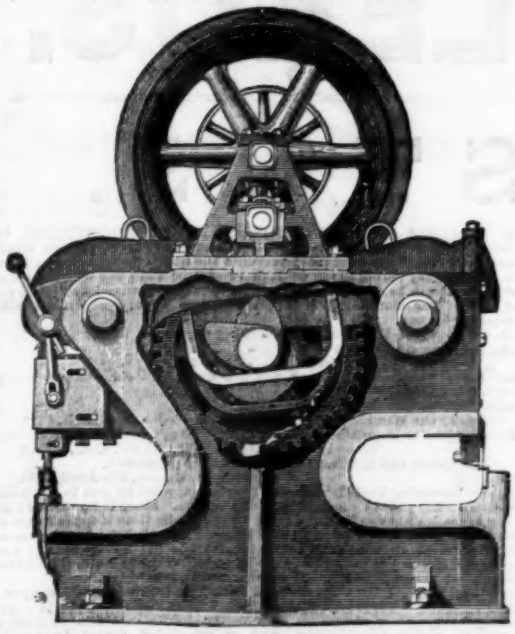
SINKING, FEEDING BOILERS AND STEAM FIRE ENGINES,

Of which he has made over 9000.

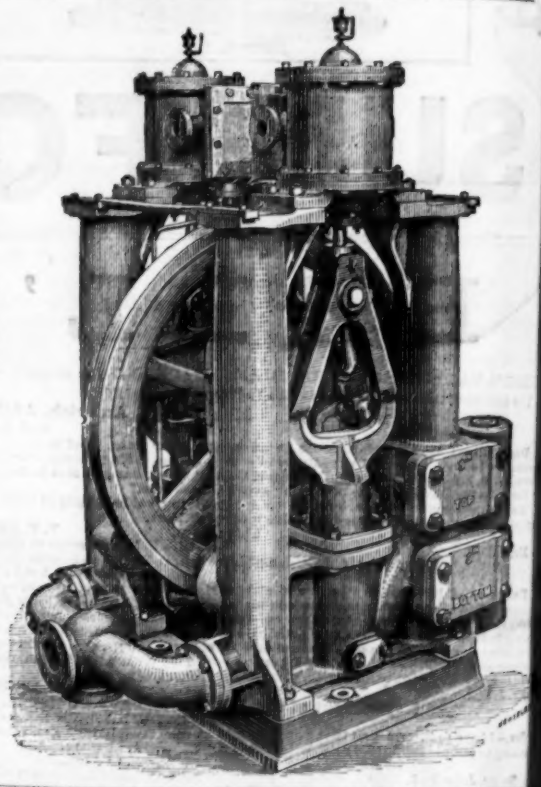
ALSO, HIS

PATENT CAM AND LEVER PUNCHING AND SHEARING MACHINES.

FLY-WHEELS ON BOTH SIDES.



DISENGAGING APPARATUS.



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HEPBURN'S PUMP LEATHER WATERPROOF

By a special method of preparation this leather is made solid, perfectly close in texture, and impermeable to water; it has, therefore, all the qualifications essential for pump buckets, and is the most durable material of which they can be made. It may be had of all dealers in leather, and of—

HEPBURN AND GALE, LIMITED,
TANNERS AND CURRIERS,
LEATHER MILL BAND AND HOSE PIPE MANUFACTURERS,
LONG LANE, SOUTHWARK, LONDON.
Prize Medals, 1851, 1855, 1878, for
MILL BANDS, HOSE, AND LEATHER FOR MACHINERY PURPOSES.

PERFORATED SHEET METALS

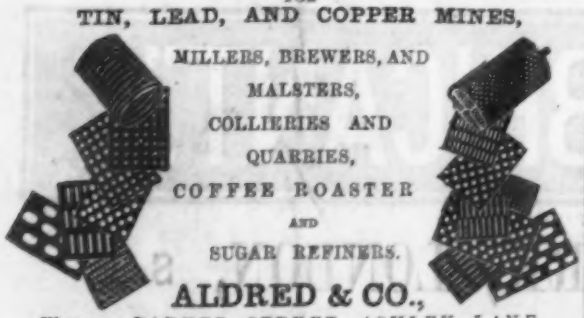
FOR

TIN, LEAD, AND COPPER MINES,

MILLERS, BREWERS, AND MALSTERS,

COLLIERIES AND QUARRIES,

COFFEE ROASTER AND SUGAR REFINERS.



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MANUFACTURERS OF

Lapwelded & Buttwelded Wrought-iron, Steel, or Homogeneous Tubes

FOR EVERY

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CRANE, INCLINE, AND PIT CHAINS,

Also CHAIN CABLES, ANCHORS, and RIGGING CHAINS, IRON and STEEL SHOVELS, SPADE FORKS, ANVILS, VICES, SCYTHES, HAY and CHAFF KNIVES, PICKS, HAMMERS, NAILS, RAILWAY and MINING TOOLS, FRYING PANS, BOWLS, LADLES, &c., &c.

Crab Winches, Pulley and Snatch Blocks, Screw and Lifting Jacks, Ship Knees, Forgings, and Use Iron of all descriptions

WELDED STEEL CHAINS { FOR CRANES, INCLINES, MINES, &c., MADE ALL SIZES.

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